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creative computing

BUYER'S GUIDE TO PERSONAL COMPUTERS PERIPHERALS AND ELECTRONIC GAMES 1983

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- How To Buy A Personal Communications Terminal
- Paddles And Joysticks: A Comprehensive Comparison
- What's New In Video Games
- Comparison Of Pac-Man Games
- Music And Speech Synthesis
- Memory Expansion For IBM, TRS-80, Atari
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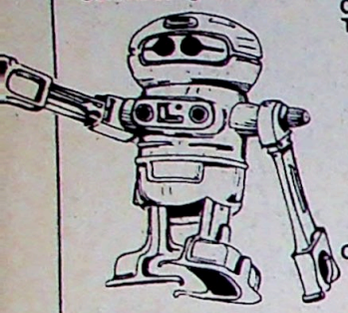

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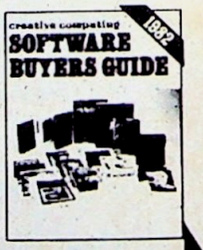

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CIRCLE 142 ON READER SERVICE CARD

Which Computer Is For You?

Betsy Staples

"Which computer should I buy?" The first time I heard someone ask this question I was all ears: how would my new co-workers at Creative Computing, who knew all about these little computers, answer? Three years later, I have become accustomed to the question, and equally accustomed to the answer, which hasn't changed: "It depends on what you want to do with it."

Sometimes, the questioner, trying to brush aside what he feels is an evasive answer, will persist: "But which computer do you use at Creative Computing?"

"Well," we reply "we have quite a few TRS-80s (Models I and III), a bunch of Apples, several Ataris, a couple of PETs, a Sorcerer, a TI 99/4, a TRS-80 Color Computer, a VIC-20, an LNW 80, an H-89, an Altair, an Imsai 8080, a Sol 20, a PDP-11/34, an IBM System 34 and dozens of Sinclairs, not to mention a miscellaneous assortment of others on short term loan for evaluation."

"But which one do you *use*?" comes the exasperated response.

"It depends on what we want to do," we say calmly, completing the first lap of the vicious circle.

And it really does . . . . If you are considering the purchase of a computer, the first thing you must do is decide what you want to do with it.

If you are motivated by a desire to improve the efficiency of your small business, for example, your criteria will develop differently than if you are an artist or musician looking for a new medium through which to express yourself.

If you are an engineer, your needs will differ from those of a professional writer. An elementary school teacher will have different requirements from a high school physics teacher, and a person who just wants to find out what personal computing is all about will have a different approach from a professional programmer looking for something to do on a busman's holiday.

Once you have decided on the primary use to which you want to put your computer, you might also want to consider possible secondary uses. Will another member of the family want to use the machine, which you have purchased to keep track of a general ledger, for word processing? Will the children be disappointed if they can't play games on it?

First the Software

Now, armed with a clear idea of exactly what you want to accomplish with your computer, you can begin to investigate the software available to help you accomplish it. As our publisher is fond of saying, "hardware without software might as well be a boat anchor," and since there are many things less expensive than computers that can be used for boat anchors, it is important to know what software is available.

If you find the software you want, the choice of hardware will probably follow very logically and painlesly. For example, we purchased our PDP-11/34 because the software we wanted to handle our subscription fulfillment was written for that machine. When we decided to computerize the rest of our internal accounting functions, we told ourselves we wanted hardware that would be compatible with the 11/34, of which we had become quite fond.

It soon became apparent that the creation of software for the internal accounting would have to be a custom job, so we consulted several software houses, only one of which presented a comprehensive proposal at a relatively reasonable price. Although the proposed system would do everything we needed, we were forced to abandon our dreams of compatibility, because the software was for an IBM System 34.

In the same manner, on a slightly smaller scale, a consulting engineer of our acquaintance recently purchased three TRS-80 Model IIIs for his business solely on the strength of an air conditioning design package offered by the Carrier Corporation for that machine. He needed to design air conditioning systems and he found the software to do it. The decision to buy the TRS-80 was made for him. He has since discovered word processing, and we've heard rumors about draftsmen becoming engrossed in Adventures during lunch hours, but these are secondary uses which played no part in his decision to buy.

Of course, if you are a programmer with sufficient experience to write your own software, you can skip this step and proceed with the purchase of the hardware.

Then the Hardware

Perhaps you have found the perfect software, it is available for only one machine and you are satisfied. Great. But what if there are several packages that meet your needs, and each is written for a different computer? Or what if the manufacturer sells the same super package for several machines?

Obviously, the field from which you will choose has been narrowed, but there are still some things to consider.

Lower Case

If you plan to use your computer for word processing, you will probably want both upper and lower case characters.

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When you program GBS, all the tools are immediately available. You may program and test without requiring an outside editor, assembler, or compiler. Thus, changes may be made and tested in seconds.

You program GBS by making table entries using a full screen editor. The tabular structure allows GBS to execute your applications and those created using the GENerator programs extremely rapidly.

You may construct screens with a full screen editor. Later, your programs will display these screens with a single instruction. You may use subroutines to shorten and organize your programs. The fields in a record may be referenced like an array. And for those learning to use GBS, there are valuable HELPs available on call.

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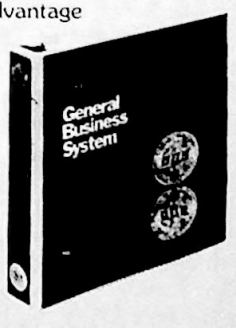

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CIRCLE 177 ON READER SERVICE CARD

Some computers have both, some have only upper case. Some of the ones that have only upper case can be modified to include lower case. Some of these modifications are easier to use than others.

If you want to do word processing, you will need a printer, and will want to ask which printers work with which computers, what features they offer and how much they cost.

Graphics and Sound

Color, animation and sound may be superfluous on a computer purchased for word processing, but they can be useful, if not indispensable, for games and certain educational uses. They can also enhance charts and graphs created in the office.

Most of the popular computers available today have at least some graphics capabilities built in, but some go far beyond the basics. Graphics tablets, graphics printers and plotters to increase flexibility of input and output are available for some machines.

Some computers have sound capabilities, while others are mute. Sound can greatly enhance game playing, but doesn't add much to bookkeeping functions.

There are also music synthesizers available for some computers, and if you are musically inclined, you might want to make this one of your secondary criteria.

Expansion Options

If you are like most people who buy computers, you will soon outgrow the first system you buy. You will want more memory, a disk drive or two, a printer, or one of the hundreds of other peripherals on the market.

The time to consider expansion options is before you make the initial purchase. Once you have a particular machine, the growth of your system is limited by the provisions its manufacturer has made for expansion. On some computers, peripherals can be attached simply by plugging in a cable. On others, you may have to purchase an expensive interface before you can think of adding so much as a joystick.

You may be able to buy peripherals from several manufacturers or you may be limited to purchasing them only from the maker of the machine.

Service

What will you do if it breaks? Will you be able to take it back to the store from which you purchased it, will you have to send it back to the manufacturer, or will you be forced to find an independent person or company to repair it?

The personal computer industry is growing rapidly, and the number of service centers has not always kept pace with the proliferation of machines in the home and office.

Once you become dependent upon your computer, you will not want to be parted from it for long. Whether you are sending it for modification or repair, you will want fast, reliable service, so investigate the availability of service before you need it.

Price

The computers we use at Creative Computing range in price from $99.95 to $50,000. Obviously, the build-it-yourself ZX80 could not do the job of one of the minis, but the System 34 would be just as inappropriate for use in our Community Education Center. So a higher price tag does not automatically designate a better computer.

For certain applications, the low-end computers can do just as good a job as their more expensive relatives. For others they will be found woefully inadequate. Neither should you spend more than you can afford just because a certain computer has many features. If those features are not applicable to your use, you may never need them.

A higher price tag does not automatically designate a better computer.

There are always trade-offs when it comes to price. We could have equipped our Education Center with one of the higher priced, multi-featured personal computers, but we would have had to settle for far fewer of them. We decided, instead, that, in this case the opportunity for hands-on experience was more important than exposure to special features, so we bought a larger number of low-end computers so that each student could have one.

You may decide you would rather have a lower priced computer with a disk drive than a higher priced one with a cassette recorder. Or, you may need the extra features of the higher priced machine and be willing to put up with the inconvenience of the recorder to get them.

Where to Buy

Having decided what you are going to do with your computer, what software can do the job, and what computer you want to buy, you are faced with deciding where to buy it. Should you go back to your local ComputerLand, Radio Shack or independent computer store where you have already spent several hours playing with the equipment and asking questions? Or should you take advantage of some of the excellent discounts offered by mail order firms?

This is not an easy question to answer. If you are clever at such things and can install and repair the machine yourself, or don't mind taking your chances on getting it fixed when the time comes, then mail order may be a good alternative for you. By shopping carefully, you can often save a substantial amount of money on hardware purchases.

If, however, your system will be composed of components from several hardware manufacturers which have to be put together or you are likely to need fast service on your system, you would do well to consider paying a little more for your computer in order have ready access to the knowledgeable folks at your local computer store.

Where to Find the Information

"This is all well and good," you say, "but where can I find all this information on everything from software to service?"

Obviously computer stores are a good source of information about the brands they sell, user's groups can list the advantages of the computer owned by their members, and friends can tell you the pros and cons of their machines in a relatively unbiased manner.

Having exhausted those sources, however, you may still find yourself hungry for information. Magazines are probably the best source of up-to-date, unbiased evaluations of the products on the market. If the current issue doesn't mention the product you are looking for, get an index and look for it among the back issues.

Some magazines are devoted to a specific computer; others are of more general interest. Both can be useful in investigating the applications and products available to the prospective computer owner.

Evaluations by current users list the good and bad features of the product, describe some of the best uses for it and evaluate the documentation. If the writer has had any problems with repair or installation, he will also include the details of obtaining service. Evaluations of this sort can be extremely valuable to the prospective purchaser.

And don't overlook the advertisements and new product announcements. They often contain enough information to allow you to decide whether to consider the product further.

Which computer should you buy? If you do your homework as outlined above, you should have very little trouble deciding. □

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CIRCLE 104 ON READER SERVICE CARD

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by Jeff Zinn

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CIRCLE 115 ON READER SERVICE CARD

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the IBM personal computer

Will Fastie

As I stepped from my car into the South Florida swelter, a wave of apprehension swept over me. Betsy had worked hard to get early delivery on an evaluation unit. She was politely, but firmly, refused.

I had arranged to work in the Baltimore office on their machine. Those plans were politely, but firmly cancelled. We shared our frustration: didn't these people understand the small computer market, and didn't they want the world to know about theirs?

Now I stood in front of the Entry Systems Business Division (ESB) of the Information Systems Division (ISD) of International Business Machines Corporation (IBM) in Boca Raton, FL, home of the IBM Personal Computer. I wondered if my time inside would prove as difficult as the negotiations that led me here.

W. H. Fastie, 7110 Sheffield Rd., Baltimore, MD 21212.

As I entered the contemporary but unremarkable building, a wave of comforting cool air swept over me. It was but the first of many pleasant experiences I would have in the next two days. I politely, but firmly, announced myself.

IBM has overcome the burden of their tradition while using that tradition to their best advantage.

I was met by Jeannette Maher from the Public Relations department, with whom I had arranged my visit. She escorted me into an area that looked like IBM's conception of the ideal retail environment in which to market their new Personal Computer. We walked through a tastefully decorated lobby area and through smoked glass doors set into a wall of smoked glass. Inside we passed IBM's show display wall, and there they were. Three IBM Personal Computers sat on three modular display stations. A little voice inside me screamed "Be *objective*!" and I started to drool.

Inside this quiet room I was looking at what, to me, represents a revolution in small computers. IBM is entering a market that is just passing out of adolescence, but is well-established. This is both a disadvantage and an advantage for them. The problem is that they have built a machine which is vastly different and for which very little support can be found in the general market.

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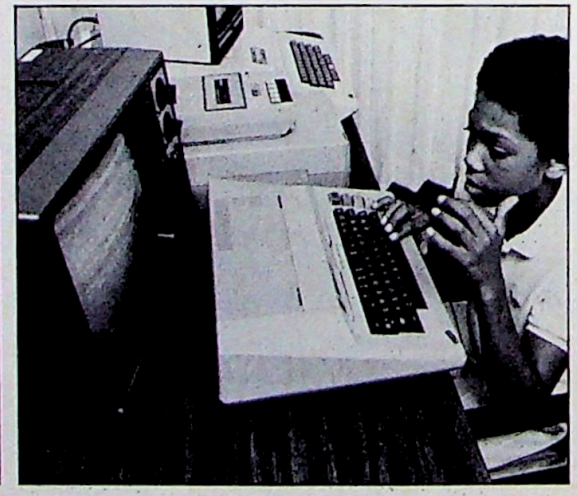

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*From a review in the "Instructional Computing Newsletter"; MECC, May 1982.

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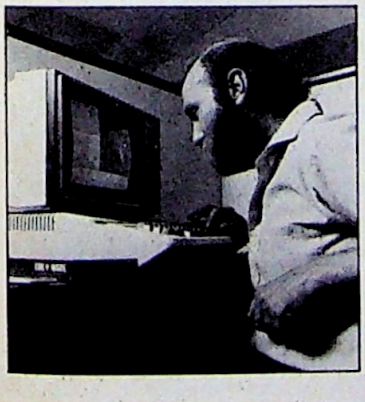

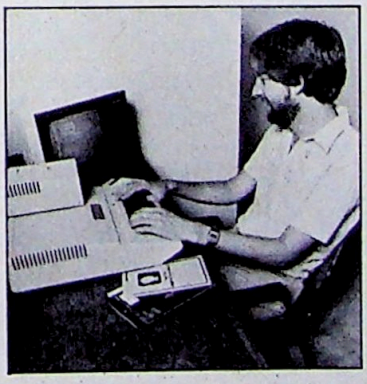

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The advantage, of course, is that they have the experience of others from which to learn and can "do it right." I think they have done it exactly right, some disappointment notwithstanding. And to have done it right means that IBM has overcome the burden of their tradition while using that tradition to their best advantage. IBM considers this a breakthrough because they have depended on outside sources for software, and because of the new ways in which they will support their software.

Why is this a revolution? The IBM Personal Computer is the first in the second generation of small systems. It uses the Intel 8088 CPU, a 16-bit, single-chip processor which, besides being intrinsically more powerful than the common 8-bit machines, allows the incorporation of up to one million bytes of main memory. IBM designed for the entire address space and announced expansion to and support for up to 256,000 bytes of main memory. The design of the Personal Computer allows it to span the entire market for small computers from the home consumer through the small business to the large, so-called "Fortune 1000" companies. No other small system offers this breadth of market satisfaction as well as an extraordinary combination of price, performance, feature, and function.

Overall System Description

The computer has been designed with an eye for aesthetics without sacrificing practicality. Each of the four major components is clothed in subtle tones of beige and eggshell white; these colors allow the system to blend into any environment.

The display is one of the sharpest, clearest, most attractive I have ever seen.

The system unit, which houses the electronics and the diskette drives, is 16" deep, 20" wide, and 6" high. There is a bezel on the front which makes an otherwise boxy look. The edges are softly rounded and the top is perfectly flat to accommodate a display device. The on/off switch is large and red, and is located at the far rear edge on the right side, out of accidental reach.

All cables connect to the rear of the unit. The detachable AC power cord plugs into a male receptacle on the left side (as viewed from the rear). There is a female receptacle next to that which is intended as a power connection for a display device and which is controlled by the main power switch. Also on the left is an air vent through which air is exhausted from the power supply. On the right are the spaces through which connectors from the various controllers protrude. There is a cassette recorder connector on the back. Space is provided for two 5 1/4" diskette drives. Either single sided, double density drives of 160K capacity or double sided, double density drives of 320K capacity can be used.

The IBM Monochrome Display is the only display device available from IBM. It is 14" deep, 15" wide, and 11" tall. It is supplied with a power cable. The housing stands on four rubber feet, and its styling is reminiscent of the IBM 3101 ASCII terminal. Two controls, for brightness and contrast, are mounted near the lower right corner of the 11.5" diagonal CRT.

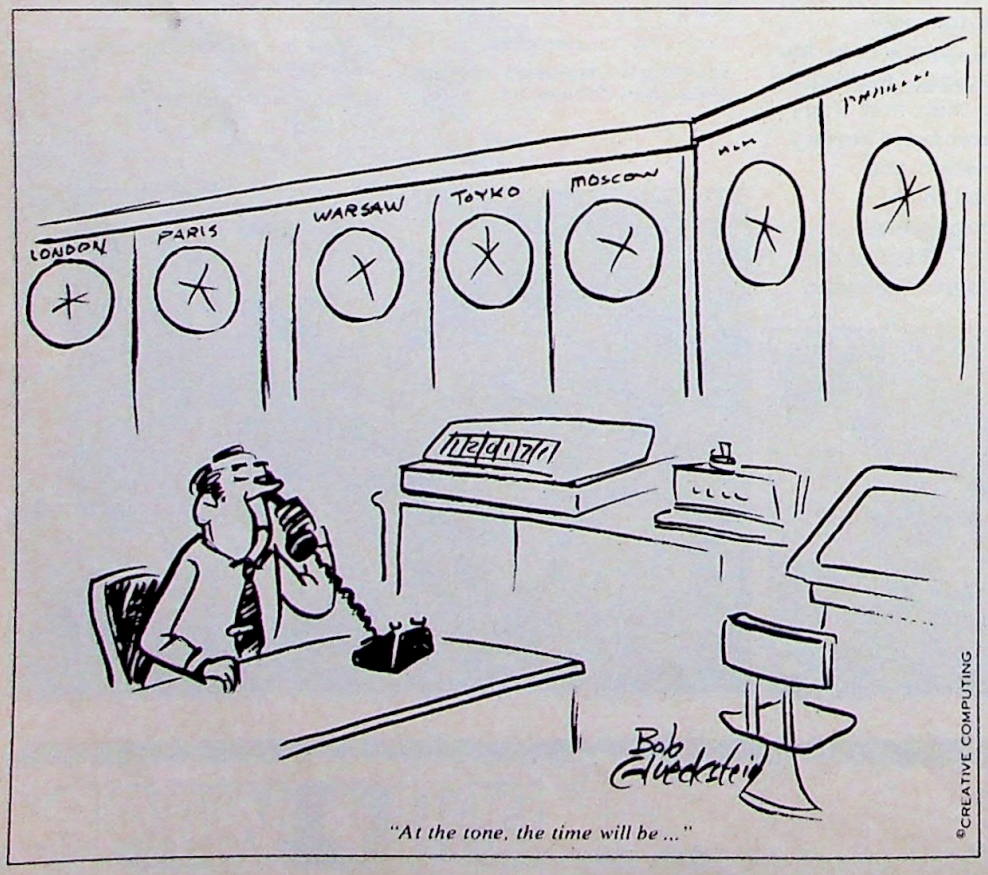
The display uses a high persistence green phosphor and generates 7 x 9 dot characters in a 9 x 14 dot box. Upper and lower case letters can be displayed as well as foreign language characters, line drawing characters, clock characters, and others; these contribute to a character set that includes over 240 displayable characters. Lower case descenders are provided. Display attributes supported are blink, reverse video, double intensity, non-display, and underline.

However, this dry commentary doesn't do justice to the display, which is one of the sharpest, clearest, most attractive I have even seen. The combination of the 7 x 9 characters and the high persistence phosphor creates characters in which the invididual dots cannot be seen and the letters appear to be fully formed.

IBM scores another point for the keyboard, easily the best among personal computers. It is 20" long (matching the width of the system unit), 8" deep, and 2.5" high. This last figure is somewhat misleading, since the keyboard can be adjusted to two angles. With its rear legs extended it is 2.5" high, but with the legs retracted it is not much more than 1" high.

The keyboard is attached to the system unit with a 6' coiled cable. It has 83 keys and includes a numeric keypad which doubles as a cursor control pad. IBM chose to make the cursor control keys the default, but wisely added a key which locks the keypad into numeric mode. A CAPS lock key makes the letter keys generate capitals.

Ten programmable function keys are placed in two columns of five to the left of the main key area. Like most standard keyboards, the shift and control keys generate additional codes. However, the combination of shift and control is not provided. Instead, the ALT key provides a fourth



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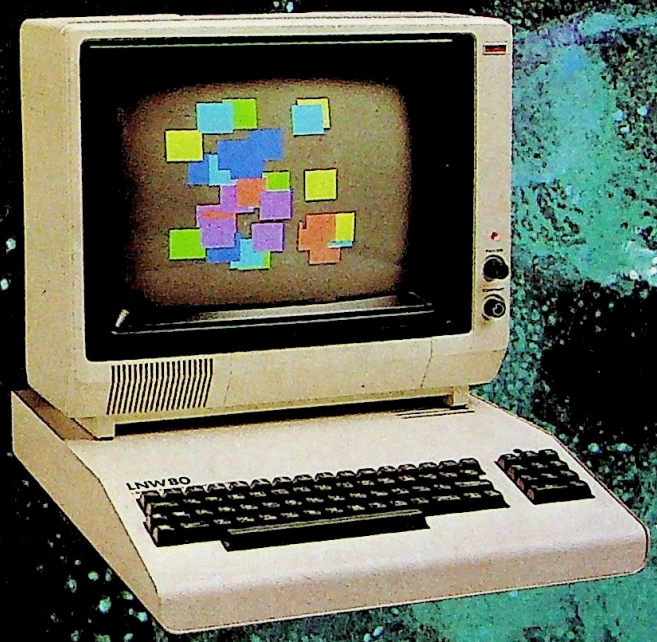

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code for each key. The "Typamatic" feature is included—each key can be held down and will automatically repeat. Depressing the ALT-CTRL-DEL keys simultaneously causes the system to initiate its power-on sequence.

The keyboard has an excellent feel. The rows of keys are angled and the keytops are slightly dished. The main keyboard is eggshell white while the control keys are beige. The keys make an audible click and provide good tactile feedback as well.

But the keyboard, nice as it is, is the source of both my first disappointment and a terrible flaw. The disappointment is the ten function keys, which I think would be better placed in a single row across the top of the keyboard, especially because IBM has provided a "softkey" display option at the bottom of the display device. I could better accept the position they are in if there was room to fit a descriptive template around them. As I say, a mild disappointment.

The flaw is the backslash key, which is placed between the left shift key and the Z key, right where the shift key is supposed to be! No kidding—look at your typewriter or keyboard. I had an awful time shifting. When I meant to type "P..." I would invariably end up with " p..." and have to back up. I started asking everyone in sight what they thought and they all said they had quickly adapted to the arrangement. That's my point exactly: no adaptation should have been required. /oh well, /i guess /i'll adapt....

The only printer IBM offers with the Personal Computer is the Epson MX-80 in IBM colors. It is equipped with a standard Centronics parallel interface. I asked if I could attach an Epson MX-100 and the answer was yes. This printer should be well known to most of you by now (see *Creative Computing*, July 1981, page 66), so I'll only mention that it is the basic MX-80 without the graphics or F/T options, and that it does not print the entire character set that the display device can generate. The twelve "type styles" to which IBM refers are various combinations of double strike, emphasis, and character spacing and are not different fonts.

The System Unit

A point of contention between *Creative* and IBM prior to my visit to Boca Raton was that IBM would not allow the cover to be removed from the unit until after the first customer shipment in October. I was delighted to receive permission to take my peek on the grounds that this article would be published after the machine was in the hands of the public. I can therefore tell you that inside the system unit there are a bunch of green cards full of little black things with lots of silver legs.

The system unit *sans* cover is surprisingly compact. Viewed from the top, the power supply occupies about an eighth of the space in the rear right corner. It is completely enclosed in steel, with an intake fan mounted directly under the top. I had not seen a fuse from the outside and none was in evidence inside; the power supply has an internal circuit breaker which resets automatically after about ten seconds.

The system unit sans cover is surprisingly compact.

The two diskette drives are mounted in the front of the cabinet and extend to within an inch of the power supply. Together, both drives and power supply take up about 2/3 of the space inside. A small speaker is mounted on the left side of the chassis near the front, and is connected to the main board with a plug.

The CPU card is mounted flat on the bottom of the chassis and extends from front to back on the left side. One corner of the board is hidden under the diskette drives. To the rear are five slot connectors into which adapter cards for the various peripherals are inserted. The slots are numbered 1 to 5 from left to right, and line up directly with five holes cut into the rear of the chassis. If the slot has no card inserted, the rear panel hole for that slot is covered with a small metal cover which is attached with a screw to the rear panel. This cover is discarded for slots to be filled, since each card is permanently attached to such a cover, through which the necessary external connectors protrude. With the card inserted and the cover screwed down, the card is held rigidly in place. The IBM designers have solved three problems in one with this clever scheme: the rear panel is clean, and completely sealed; the external connectors are firmly mounted and supported; and the adapter cards are appropriately secured.

Even though all slots are created equal electronically, allowing any adapter card to be used in any slot, IBM recommends that the display adapter card be inserted in slot 2. It turns out that display cards are as long as cards can be in the system unit, and that slot 2 is equipped with a

special plastic guide to prevent the long cards from wobbling. In response to my question "Why not guides for all the slots?" IBM replied that it represented an additional manufacturing process. Each slot has the holes that support the guides, so the guide in slot 2 can be moved and additional guides could be added.

The Intel 8088 CPU is placed in a socket on the right rear corner of the board. Right next to it is an empty 40-pin socket. IBM in Boca Raton "refused to speculate" about the purpose of the socket but two other sources within IBM stated that it was for future inclusion of an Intel 8087 floating point processor (see box). The CPU board also contains 40K (kilobytes) of ROM (read only memory) in five sockets, 16K of RAM (random access memory) soldered to the board, and sockets for an additional 48K of RAM. Memory beyond 64K is added with 32K or 64K memory cards which occupy system expansion slots.

There is a set of DIP (dual inline package) switches which is used to tell the CPU how many diskette units are installed, among other things. A crystal on the CPU card generates a frequency of 14.31Mhz which is divided by 3 to get a 4.77Mhz clock for the CPU, by 4 to get a 3.57Mhz clock to drive television sets, and by 1 to drive direct drive monitors.

I'm not an engineer, but to my eye, all the boards seemed well constructed. There seemed to be good separation between components and between tracks. The adapter card slots were well-spaced so cards should not touch and air circulation should not be impeded. The chassis and the cover are both steel and the entire unit is well sealed. The system has received FCC Class B certification for home computers and is UL approved.

Imagine my surprise when Basic announced it had 61404 bytes free!

The 40K of ROM that comes with every system unit contains three software elements. Two kilobytes are devoted to diagnostics which perform comprehensive tests of the entire system, including memory, whenever the system is turned on or the ALT-CTRL-DEL key combination is depressed. IBM's Basic Input/Output System (BIOS), which provides control for all devices except diskette drives, occupies 6K. The remaining 32K is a Basic language interpreter which IBM calls Cassette Basic and which is automatically started if there is not a disk in the diskette drive or if there is no diskette drive.

Basic

IBM contracted with Microsoft to provide the Basic interpreter for the Personal Computer. The version in ROM is essentially Microsoft Basic-80, version 5.x, without the statements associated with disk file access. To the best of my knowledge, it is the most extensive Basic offered in any personal computer ROM. It is certainly large; most small computers are usually delivered with 16K of ROM containing Basic and a small monitor.

What's an 8088 and What's It Doing Inside My IBM Computer?

The 8088 is a member of a family of single chip processors manufactured by Intel Corporation. The 8088, and its big brother the 8086, are processors with a 16-bit internal architecture which provides 16-bit wide registers, data paths, ALU (arithmetic/logic unit), and instructions. The 8088 and 8086 differ only in that the 8088 has an 8-bit external bus interface while the 8086 implements a full 16-bit interface. The 8-bit bus is very similar to that used in other Intel 8-bit machines, such as the 8085A, and is relatively simple to design and build.

The performance of the 8087 is spectacular.

There are two features of the 8088 processor that are extremely important. The first is its ability to address one megabyte of main memory, and the other is the "pipeline" architecture, or "prefetch" processor.

IBM has used the full one megabyte address space in the Personal Computer. The ROM is physically located at the top of the megabyte. Display adapter memory is located somewhere around the .75 megabyte boundary. Main memory starts at location 0 and includes the interrupt vector tables; available user main memory begins a few hundred bytes later. It should be obvious that this memory scheme allows for tremendous expansion and growth, not only for main memory, but for ROM and display memory as well. Eight color graphics could be obtained, for example, by doubling the memory of the Color Graphics Adapter. The same change allows four colors for high resolution graphics and doubles the resolution for black and white graphics!

The pipeline architecture allows the next instruction to be obtained from memory while the current instruction is executing. This means that the instruction processor typically does not need to wait for its next instruction and therefore has a higher effective performance. Although the 8088 is an 8-bit machine to the external world, the prefetch processing can accelerate the machine well beyond what is possible on current 8-bit machines.

There are two other members of the 8086 family. One is the 8089 I/O Processor, which is a high speed, two channel I/O controller. It behaves more or less like data channels on IBM's larger systems. The other member, far more interesting to the IBM Personal Computer owner, is the 8087 Numeric Data Processor. This chip is actually a "co-processor" which extends either the 8088 or 8086 instruction set to include arithmetic and logical operations on seven different data types, and also provides built-in transcendental functions. Adding the 8087 to 8086/8 system is transparent; the perceived result is an 8086/8 whose capabilities have been greatly expanded.

The performance of the 8087 is spectacular. Intel, in the July 1980 issue of the 8086 Family User's Manual Numerics Supplement, compares 8087 executions against 8086 software emulations of the same functions. An example, square root, performs in 19600 microseconds in 8086 and an astounding 36 microseconds with the 8087, a 54,000% improvement! Other functions are similarly fast.

The point of this discussion is that the IBM Personal Computer will become a very formidable scientific processsor when the 8087 is made available for it, and that the other applications such as VisiCalc, will be significantly accelerated.

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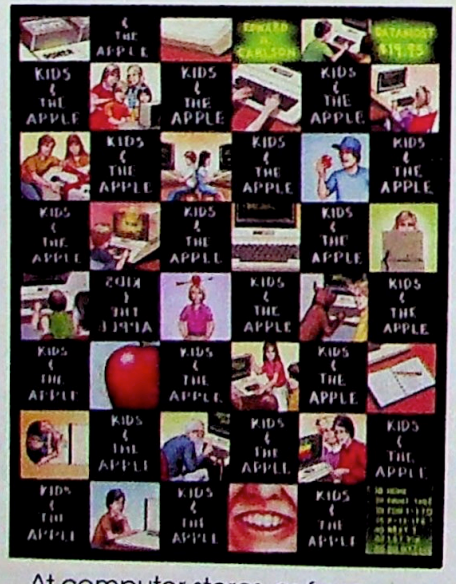

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The systems I used for my evaluation all had 64K of RAM installed. Imagine my surprise when Basic announced it had 61404 bytes free! In effect, I was working with a 104K system.

But Casssette Basic is not the end of the story. Two other versions of Basic are available for systems which include one or more diskette drives and for which the Personal Computer Disk Operating System (DOS) has been purchased. Disk Basic adds the disk file statements and makes the Basic equivalent to Basic-80. Advanced Basic adds advanced graphics, music, and some special extensions for event trapping that allow real-time programs to be written using Basic! Best of all, these Basic extensions are just that—extensions.

The kernel Basic interpreter in ROM is still used and the only memory used by the extension is that which they themselves need. Table 1 shows the sizes of the three Basic systems and the amount of user memory they leave available in a 64K system. If the main memory in the system is extended to 96K or more, all versions of Basic will have a maximum of about 60K of available user memory.

There are several special features of the IBM Personal Computer Basic. A very good full screen editor is provided and behaves intuitively. (By this I mean that depression of the cursor control and editing keys produces a logical and expected effect.) Basic is able to handle communications at speeds up to 9600 bits/second. The ALT key in conjunction with the letter keys can be used to automatically generate Basic keyboards, speeding entry of programs. Finally, both Disk and Advanced Basic are memory resident and do not require a disk once loaded.

The December 1980 issue of *Creative Computing* features a comparative evaluation of Basics (page 70). Table 2 lists the same "defined system characteristics" for the IBM system.

I do have one complaint about the three Basics. The DATE$ and TIME$ are not in Cassette Basic but become available in Disk Basic. These are relatively simple features, and are useful even in minimal systems. I feel somewhat the same way about the advanced graphics and music functions. These features are very useful in entertainment programs, which are most likely to run on smaller configurations. Expanding a minimal system to include Advanced Basic requires an upgrade to 48K of memory ($180), one diskette drive ($790), and DOS ($40). For the consumer who has invested $1600 in a machine with limited third-party software support, $1090 is a significant next step.

IBM has seen to a competent and powerful implementation of Basic. The availability of almost all of Basic-80 in ROM is a strong feature. The amount of available memory is a close second.

Table 3 shows which Basic statements are included with each version of the IBM Personal Computer Basic.

Table 1. Basic System Memory Utilization—64K Systems

(Memory figures are given in kilobytes)

Basic Version	Incremental Memory	Total Memory Required	Memory IBM	Available Observed
Cassette	--	4.0	60.0	61.404
Disk Basic				
DOS	12.0			
Disk Basic	8.0			
Total	20.0	24.0	40.0	41.156
Advanced Basic	5.0	29.0	35.0	35.707

Note: In all versions, a maximum 64K workspace is supported, of which about 4K is required for interpreter overhead.

Table 2. Defined System Characteristics of the IBM Personal Computer Basic

Characteristic	Implementation	Verified*
Name length	Unlimited (40 significant)	
Integer arithmetic	yes	x
Multi-statement functions	no	
Function Recursion	yes	x
Multi-statement lines	yes	x
Syntax checking	when RUN	x
String arrays	yes, 256 characters deep	
Messages	full phrase	x
Statement numbers	0 to 65535	
Dimension default	11 elements	x
Float precision, number of digits	7 single; 17 double	
Float exponent	± 38	
Float size, bytes	4 single; 8 double	
RENUM command	yes	x
Nested IF	yes	x
Max subroutine depth	none	
Link to machine language	yes	
Formatted output (PRING USING)	yes	x
Max number array dimensions	255	
Break procedure	CRTL-Break	x
Number of string functions	13	x
PEEK/POKE	yes	x
CHAINing and COMMON	yes	
Error trapping	yes	x
Random I/O	yes	
Limit of nested loops	none	
Number of keywords	158	
Trace features	yes	x

*Verified means Will saw it.

Graphics

Perhaps the most exciting feature of the IBM Personal Computer is its graphics capability. This is one place where IBM has learned their lesson well and where the price, performance, function, and feature considerations become evident.

The IBM Monochrome Display has already been described. This display device does not support graphics—it is for text only. To get at the graphics features of the machine a Color Graphics Adapter card must be installed in a system slot. This adapter allows color monitors, black and white monitors, and televisions to be connected. Television sets also require an RF modulator, which IBM does not supply. The adapter can also drive several monitors on TVs at once, in any combination.

The adapter comes with its own 16K of memory to store display information. (The Monochrome Display adapter supplies 4K to store display text.) This is absolutely terrific, because it means that even with the highest resolution graphics *no program memory is used* to store screen data! It also means that the $1595 minimal con-

Cassette Basic

ABS	DEF USR	LEFT$	PEN	SQR
ASC	DELETE	LEN	POINT	STICK
ATN	DIM	LET	POKE	STOP
AUTO	EDIT	LINE	POS	STR$
BEEP	END	LINE INPUT	PRINT [USING]	STRIG
BLOAD	EOF	LINE INPUT#	PRINT# [USING]	STRING$
BSAVE	ERASE	LIST	PSET	SWAP
CALL	ERR, ERL	LLIST	PRESET	TAB
CDBL	ERROR	LOAD	RANDOMIZE	TAN
CHR$	EXP	LOCATE	READ	TRON, TROFF
CINT	FIX	LOG	REM	USR
CLEAR	FOR, NEXT	LPOS	RENUM	VAL
CLOSE	FRE	LPRINT [USING]	RESTORE	VARPTR
CLS	GOSUB	MERGE	RESUME	WAIT
COLOR	GOTO	MID$	RETURN	WHILE..WEND
CONT	HEX$	MOTOR	RIGHT$	WIDTH
COS	IF..THEN..ELSE	NEW	RND	WRITE
CSNG	INKEY$	OCT$	RUN	WRITE#
CSRLIN	INP	ON ERROR	SAVE	
DATA	INPUT	ON..GOSUB	SCREEN	
DEF FN	INPUT#	ON..GOTO	SGN	
DEFINT	INPUT$	OPEN	SIN	
DEFSNG	INSTR	OPTION BASE	SOUND	
DEFDBL	INT	OUT	SPACE$	
DEFSTR	KEY	PEEK	SPC	

Statements added by Disk Basic

CHAIN	DATE$	LOC	MKD$	SYSTEM
COMMON	FIELD	LOF	NAME	TIME$
CVI	FILES	LSET, RSET	OPEN "COM...	
CVS	GET (files)	MKI$	PUT (files)	
CVD	KILL	MKS$	RESET	

Statements added by Advanced Basic

CIRCLE	GET (graphics)	ON KEY	PAINT	PUT (graphics)
COM	KEY (n)	ON PEN	PEN STOP	RETURN line
DRAW	ON COM	ON STRIG	PLAY	STRING (n)

Table 3. Basic Statements

sumer configuration of a system unit and color graphics card actually provides 32K of memory—16K for program and an independent 16K for the display—and is eminently useable. And yes, in Basic you are still left with the available memory shown in Table 1. The adapter will also support a light pen, although IBM does not make one available, and light pen statements are included in Basic.

The adapter supports two text modes and two graphics modes. The text modes have resolutions of 25 lines of either 40 or 80 characters. There are 16 foreground and eight background colors. These modes can either be used for text or for block graphics, using the characters in the display set Incidentally, the same character set is supported on both the Monochrome Display and the Color Graphics Adapter, so software does not need to know the difference.

The medium resolution graphics mode uses 200 dots vertically and 320 dots horizontally, and four colors can be displayed. Other colors may be created by plotting dots of different colors next to one another.

The high resolution graphics mode uses 200 dots vertically and 640 dots horizontally, and is limited to black and white. The adapter allows horizontal text to be interspersed with graphics; PRINT statements from Basic output the text, and no special control or character generation is required from the software. In graphics mode, the character set is limited to 128 characters, which can be user-defined. The characters are 7 x 7 dots in an 8 x 8 box, with a single line of pixels for descenders. All display attributes of the Monochrome Display, except underline, are supported.

Even with the highest resolution graphics no program memory is used to store screen data!

On a monitor, the adapter easily displays 80-character lines. On a television set, overscan will probably cause information on both the left and the right to be lost. The Color Graphics Adapter can be told to shift the display to overcome the problem, if only on one side. On some TVs it may be possible to see the entire 80 columns; on most, this is unlikely.

In text mode the adapter can support multiple pages of text. If the display mode is 25 x 40, four pages can be stored, and in 25 x 80, two pages are stored. An "active" and "visual" page can be specified. The visual page is the one which the display hardware uses. The active page is the one written to with, for example, PRINT statements in Basic. Basic allows full control of this feature, which can be used to switch rapidly between screens of text or to animate using character graphics.

Cassette Basic provides a complete, if not elaborate, set of statements that allow access to the color graphics features. The COLOR statement is used to select the colors that will be displayed. The LINE statement can be used to draw a line from any point to any other point on the screen,

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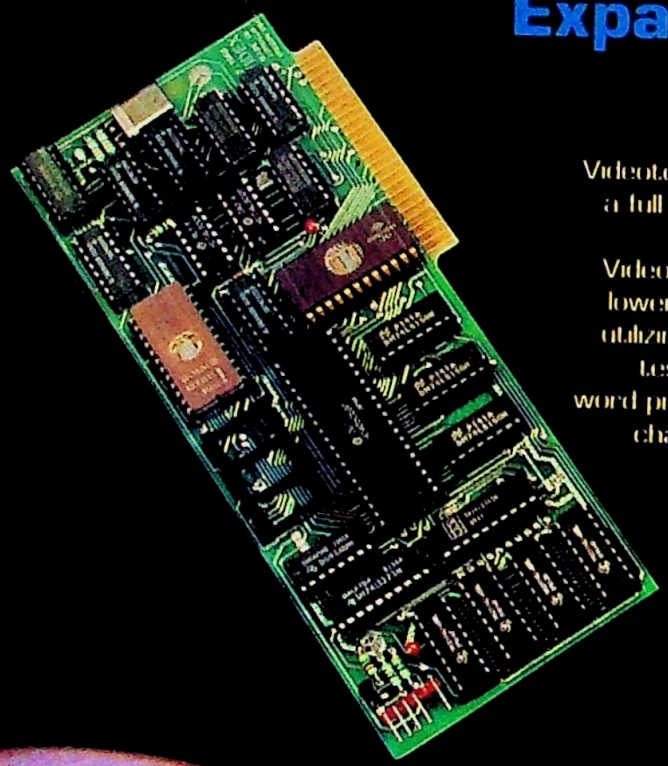
VIDEOTERM

Expanding Horizons in Text Display



Videoterm increases your Apple][+* display to a full capacity 80 columns. Proofreading text problems are a thing of the past. With Videoterm your text is displayed in upper and lower case characters with true descenders utilizing a 7 by 9 character matrix. The time-tested Videoterm is compatible with most word processors and is available with alternate character fonts. Once you've explored the advantages of Videoterm, you'll discover a whole new world for you and your Apple][.

Suggested retail price: $345.00

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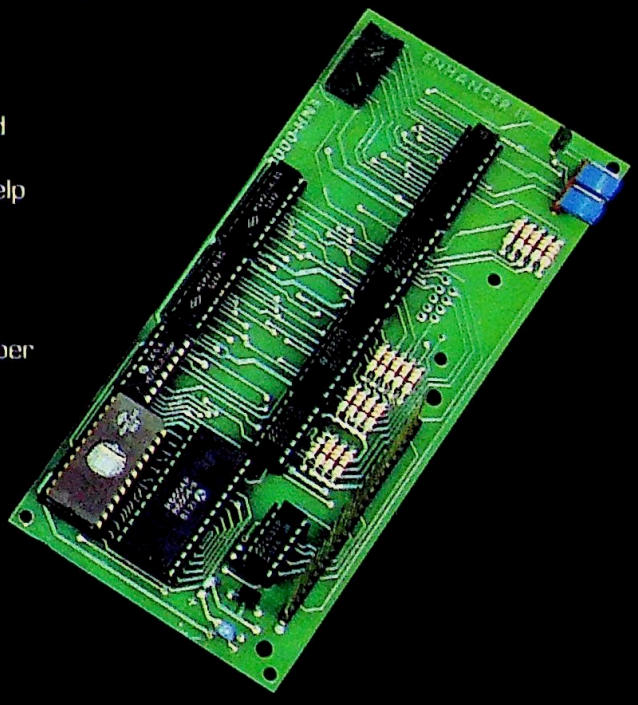
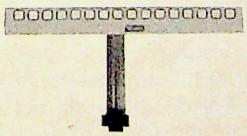
The Dawn of a New Era for Apple][

Introducing the Enhancer][: a new Standard which is improving the relationship between Humans and Apples. The Enhancer][can help your Apple]['s keyboard become more sociable by remembering words or phrases which can be entered into the Apple by the mere touch of a key. Life can become even easier because the Enhancer][can remember what you typed while your Apply was busy talking to your disc (or doing other things). Naturally, it knows the difference between upper and lower case letters and what shift keys are supposed to do. It even knows to auto repeat any key held down. The Enhancer][replaces the encoder board making installation simple.

Suggested retail price: $149.00



Function Strip™

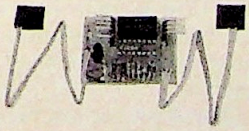


With the Videx Function Strip you can dedicate keys for your macro definitions, program word processor commands, words or phrases for your Enhancer][, Apple][™ Function Keys. VisiCalc® users can define often used commands and file names to a single keystroke.

This low cost, versatile strip of pressure sensitive switches adheres to the Apple]['s lid and connects to the Enhancer]['s keypad connector port.

Suggested price: $79.00

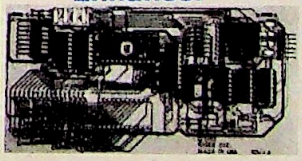
Soft Video Switch™



The Soft Video Switch is an automatic version of the popular Switchplate. It knows whether it should display 40 or 80 columns or Apple graphics. It does the tedious work of switching video-out signals so you don't have to. The Soft Video Switch can be controlled by software. Any Videoterm with Firmware 2.0 or greater may be used with the Soft Video Switch. The single wire shift mod is also supported.

The price is: $35.00

Keyboard and Display Enhancer™



The original Keyboard & Display Enhancer is still available for Revision 0-6 Apples (on which the new Enhancer][will not fit). These Apples have memory select sockets at chip locations D1, E1 & F1. The Keyboard & Display Enhancer allows entry and display of upper and lower case letters with fully functional shift keys. It does NOT have user definable keys nor a type ahead buffer.

Suggested price: $129.00

Accessories

Videoterm Utilities Disc $37 (includes)
- Font Editor
- Mid-Res Graphics
- Applesoft Read Screen Utility
- Top & Bottom Scrolling
- Pascal Vidpatch
- Graphics Template

Character Set EPROMs $29
- Inverse
- German
- Katakana (Japanese)
- Russian
- French
- Math & Greek Symbols

High light, low light character set $49

Dvorak EPROM (Enhancer) $29

Lower Case Chip $29

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CIRCLE 194 ON READER SERVICE CARD

to draw any rectangle, and to fill any rectangle with solid color. PSET and PRESET are used to set or erase any point on the display. The SCREEN statement selects the graphics mode.

Advanced Basic has very powerful graphics capabilities. The CIRCLE statement draws any circle, ellipse or arc, and can also connect the ends of arcs to the center point, a kind of automatic pie-chart feature. The DRAW statement interprets a character string for commands which can be used to build arbitrary shapes. PAINT fills a space with a specified color in all directions, and stops only when blocked by another color. The most powerful commands, however, are GET and PUT. GET is used to read a section of the screen memory into a Basic array. PUT works in the other direction, transferring the array to screen memory.

With a little help, I wrote a graphics program in Advanced Basic that animated a ball. I didn't have time for anything elaborate, so I just made it move across the center of the screen from left to right.

First, I used CIRCLE to draw the ball, and PAINT to fill it with another color. Then I used GET to retrieve the bit pattern I had drawn from the screen memory. After clearing the screen, I was able to PUT the ball anywhere I wanted to. PUT is also used to erase the object. My program consisted of a short loop which PUT the ball, paused, PUT the ball again to erase it, and advanced by some fixed step to the right. It took me 10 minutes to write this program. I could just as easily have used the DRAW command to build an arbitrarily complex shape, and moved it around. By the way, when I ran my ball program with 15 steps across the screen the ball got from left to right in about a second.

IBM has written a set of demonstration programs which will be available to their dealer network. Some of these programs demonstrate the graphics capabilities very effectively. But here's the shocker—the programs are written in Basic!

Table 4 shows how the IBM Personal Computer stacks up with other personal computers having color graphics capability. I think the Atari 800, with its graphics

The IBM Personal Computer VisiCalc Machine

A new computer in today's market finds itself in great difficulty if there is little or no software available for it. The IBM Personal Computer surely falls into this category. The few packages available through IBM cannot compare to the volume of software currently available for CP/M-based systems, for example. Given this circumstance, how does IBM plan to sell a significant number of machines before the software base is established?

Everyone, from accountant to the Information Systems VP will feel warm and comfortable with a computer bearing the same logo as the big blue monster in its lair downstairs.

I believe the answer lies with VisiCalc and in the three letters I-B-M. IBM is firmly entrenched in the world's largest corporations with its line of mainframe systems. These clients of IBM's Data Processing Division (DPD) are prime targets for an aggressive marketing effort. The DPD salesman can offer a large firm an independently programmable computer (distributed processing), an IBM compatible terminal (a 3270 emulator is a stated IBM "intention"), and the big gun, VisiCalc.

Assuming IBM and Software Arts remove the current memory limitation of VisiCalc, and there is really no reason to think that problem won't be solved, the DPD salesman can overcome the two traditional obstacles to distributed small computers: name (identity) and capacity. Everyone, from accountant to the Information Systems VP will feel warm and comfortable with a computer bearing the same logo as the big blue monster in its lair downstairs. VisiCalc, with available memory limited only by the amount installed, can deal with even the largest and most complex spreadsheets and models that financial planners and analysts require. Calling the monster by using the Personal Computer as a 3270 and writing local programs are just so much icing on the cake.

The IBM Personal Computer is also aggressively priced for this function. The chart below lists several popular VisiCalc implementations and shows the capacities and costs of each. The IBM machine is, again, not the cheapest, but it does have the best price/function ratio. Try dividing the total system price by the number of VisiCalc entries—it's an interesting exercise.

The VisiCalc machine theory is further supported by the fact that IBM has organized an independent sales organization within DPD specifically to market the Personal Computer in this business segment. Companies ordering fewer than 20 units will be referred to the local authorized IBM dealer. DPD will handle orders for 20 or more units meeting certain minimum configuration requirements, and will offer volume discounts as follows:

Number of Units	Discount
1 - 19	0%
20 - 49	5%
50 - 149	10%
150+	15%

Resolution is shown in the form v x h, where v is the number of vertical elements and h is the number of horizontal elements.
The number of colors is shown in parenthesis

Computer	Resolution Block/Char	Resolution Low	Resolution Medium	Resolution High
Color Computer	32x64 (8) 48x64 (8)	96x128 (4) 192x128 (4)	192x256 (2)	--
Apple II	48x40 (15)	192x140 (6)	192x280 (b/w)	--
Atari 800	24x40 (4) 48x80 (4)	96x160 (4)	192x320 (2)	--
Apple III	48x40 (15)	192x140 (16)	192x280 (16)	192x560 (b/w)
IBM Personal	25x40 (16) 25x80 (16)	--	200x320 (4)	200x640 (b/w)

Table 4. Comparison of Color Graphics Capabilities

processor chip, probably outstrips IBM for performance. But when a feature comparison is made, I think IBM stands far ahead. Just think what 25 x 80 text mode means!

DOS

One of the real bargains on IBM's software shelf is their Disk Operating System (DOS) for the Personal Computer. For $40 you get a system which is about equivalent to CP/M in features, and which includes both Disk and Advanced Basic. Also included on the disk are three software development tools: DEGUG, a memory-based debugger; EDLIN, a line-oriented text file editor; and LINK, IBM's language link editor. DEBUG and LINK will only be of interest to system developers, and I will not detail them here. EDLIN is useful in general, but it is so simple to learn and use that I'll leave it as an exercise (I always wanted to say that). I have been told that some Basic programs will be included to serve as programming examples. I was also told that these would be the dealer demos.

Table 5 lists the DOS commands and the functions they perform. Here again I have little upon which to comment. I will mention that I timed FORMAT, DISKCOPY, and DISKCOMP commands. Formatting a disk took 34 seconds. Disk copying required 52 seconds. Disk copying using only one diskette drive required one minute and 38 seconds, and required four disk manipulations. Disk comparison required 33 seconds. All these times are quite reasonable.

I will also mention that I was impressed with the "smoothness" of operation of DOS. Messages and prompts were very clear and I was never at a loss for what to do next. The only problem I encountered was in the DISKCOMP program, which refused to let me abort it, and placed the system into a state which could not be cleared by anything less than a power up sequence (ALT-CTRL-DEL would not do it—I had to hit the red switch!) Nothing else I did caused any problems.

For $40 you get a system which is about equivalent to CP/M in features.

Applications

There are three software systems which IBM is providing initially. All have been reviewed by *Creative* at one time or another, so I'll keep it brief.

IBM selected accounting software from Peachtree Software, which has an excellent reputation in this field. General Ledger, Accounts Payable, and Accounts Receivable are available. I ran the Accounts Payable system to get a feel for how it operates. I can only report that operation was straightforward, but a careful reading of the documentation is essential. The software does take some advantage of the IBM display and keyboard.

EasyWriter from Information Unlimited Software, Inc. should be well-known to Apple owners and *Creative* readers. I read the manual carefully and tried the system. I can report that the program lives up to its name—it is very easy to use. I was interested to learn why IBM chose EasyWriter. The answer I got was that IBM had done a careful study of word processing software ranging in price from $30 to $600 and up and decided to select a package priced somewhere in the middle. Also contributing to the decision was time; since EasyWriter is written in Forth, it was readily ported to the 8088.

I do have one strong objection to this word processor: it uses its own file system and thus cannot read VisiCalc reports or other DOS files.

IBM's VisiCalc is the most recent edition of that famous system from Personal Software/Software Arts. The recent enhancements include the ability to edit formulas, print formulas, output to the RS-232 port, and write files in the DIF (Data Interchange Format). One problem I noted was that VisiCalc (called VC80 in DOS) expects to be loaded from disk A. I caused an error when I tried to run it from disk B. Two advantages are that scrolling (on the Monochrome Display) is flicker free and very fast and that the Typamatic feature of the keyboard can be used with cursor movement keys to scroll anywhere rapidly.

I did do a VisiCalc benchmark. I entered a very small spreadsheet consisting of 11 legends, 6 numbers, and 98 formulas. Using my very accurate Casio AQ-2000 clock/

Table 5. IBM Personal Computer DOS Commands

Command	Function
CHKDSK	Check disk and report status (space used/left)
COMP	Compare files
COPY	Copy files
DATE	Enter Date
DIR	List filenames from disk
DISKCOMP	Compare diskettes (physical)
DISKCOPY	Copy diskettes
ERASE	Delete files
FORMAT	Format diskette
MODE	Set mode for printer or display
PAUSE	Causes system to wait
REM	Display Remark
RENAME	Rename files
SYS	Transfer DOS system image to formatted diskette
TIME	Enter time
TYPE	Display file contents

calculator/calendar/stopwatch, I clocked the time it took to recalculate the entire sheet by entering a number in the upper left corner and waiting for the lower right entry to be updated. On the IBM machine this took 2.6 seconds. I ran the test three times. On a Radio Shack TRS-80 Model II the same test took 2.1 seconds. To say the least, I was surprised, and I have no explanation for the result. IBM told me that they had done some benchmarks for VisiCalc performance, and that the Personal Computer had beaten all challengers.

This implementation of VisiCalc is disappointing in one respect. In a 64K system, VisiCalc leaves about 24K of workspace. If you add memory to the machine, the workspace can rise to about 36K, but not higher. IBM says the next release is in the works and will allow the workspace to be all of available memory. This would mean 88K of workspace in a 128K system. IBM says that there will be a slight charge for the new version, even to people who paid for the original version. It seems silly for this not to be perfect on the first release.

Pascal

I ran out of time before I got a chance to pursue Pascal. IBM tells me it is Microsoft Pascal-86, which is highly optimized and produces very tight direct code. Programs can run in systems with less than 128K of memory but the compiler requires that much to execute. Pascal programs can be greater than 64K, up to the limit of available memory.

The documentation, at least that which I have seen, is superb—truly excellent.

Games

IBM announced two "entertainment" products for the personal computer, one in software and the other in hardware. The soft product is Microsoft Adventure. I played it briefly, and recognized it as relatively standard Adventure. It is supposed to have some good features, but I'm not a good enough player to get far enough to learn about them.

The hard product is called the Game Control Adapter. This adapter can interface two joysticks or four paddles, none of which are supplied by IBM. The only thing I can tell you is that I saw a drawing of joysticks while I was visiting IBM and they look like Radio Shack joysticks.

Diagnostics

IBM offers a package of diagnostic programs called the Advanced Diagnostics Package. The package costs $155. I tried them and although they did not find anything wrong with the system I was using, I found them to be well designed, at least from the human factors point of view. They are coordinated with the Guide to Operations manual, and it should be possible for non-technical people to use them effectively.

I object, however, to their cost. IBM should be able to save themselves that cost by placing the very best diagnostic tools possible in the hands of the user. Such a gesture would probably improve the owner's ability to localize the problem, making it possible for IBM to deal with a greater percentage of truly broken equipment. If IBM won't give them away, I would at least plead for a more reasonable price.

Documentation

The documentation, at least that which I have seen, is superb—truly excellent.

The "IBM Personal Computer Reference Library" is a set of manuals printed on 5 1/2" by 8 1/2" paper and bound in standard 9" 3-ring, looseleaf binders. A rigid slipcase is provided so that the manuals will stand properly on a shelf. The binders are color-coded so they can be quickly identified; the colors are muted pastels and quite attractive.

The insides are just as nice. The Basic manual is a good example, but these comments apply as well to the other manuals I saw. The Basic manual is organized as a *reference* manual. In the reference section, one or more pages are devoted to each Basic keyword. The keyword appears in large, bold typeface at the top of each page to which it pertains.

I have found the information content to be high, but clear. The writing is excellent. I have read the manual several times and have not been able to contrive a question for which the manual did not have the answer. The index and table of contents are complete and helpful. Since the reference section is arranged in alphabetical order, use of the index will be rare. Two colors are used throughout. Black is used for the text, green for examples.

With each system delivered, IBM provides the Basic manual (which is considered part of the Hardware reference series) and the Guide to Operations. The Guide tells the owner how to setup the machine, how to operate it, how to run the diagnostics and determine the nature of problems, how to install options (option sections are not included, but come with the option when purchased), and how to pack the unit in the event it must be moved or shipped. The DOS manual comes with DOS and includes sections on the DOS commands, EDLIN, LINK, DEBUG, error messages, DOS technical information, DOS diskette allocation, DOS interrupts and

"...Looks like space junk..."

System Configurations and Pricing

I think there are four interesting configurations of the IBM machine. Of course, there can easily be many variations of these configurations, but these should give an idea of general pricing.

1a. Home system, entry level

System unit, 16K RAM, keyboard	$1,265.00
Color graphics adapter	300.00
Total	$1565.00

1b. Home system, entertainment

System unit, 16K RAM, keyboard	$1,295.00
48K expansion memory	270.00
Color graphics adapter	300.00
Game control adapter	55.00
Total	$1,920.00

2. Small Business System

System unit, 64K RAM, keyboard	$1,565.00
Display/Printer adapter	335.00
IBM Monochrome display	345.00
IBM Printer	555.00
IBM Printer cable	55.00
Diskette adapter	220.00
Two 320K diskette drives	1,300.00
DOS	40.00
Total	$4,415.00

3. Fortune 1000 VisiCalc Machine

System unit, 128K RAM, keyboard	$2,105.00
Display/Printer adapter	335.00
IBM Monochrome display	345.00
IBM Printer	555.00
IBM Printer Cable	55.00
Diskette adapter	220.00
One 320K diskette drive	650.00
DOS	40.00
VisiCalc	200.00
Total	$4,505.00

4. Scientific/Academic System

System unit, 128K RAM, keyboard	$2,105.00
Color graphics adapter	300.00
Printer adapter	150.00
IBM Printer	555.00
IBM Printer cable	55.00
Diskette adapter	220.00
Two 320K diskette drives	1,300.00
DOS	40.00
Pascal compiler	300.00
Communications adapter	150.00
Total	$5,175.00
Color Monitor (not IBM)	750.00
Total	$5,920.00

function calls, and DOS control blocks and work areas.

IBM plans to publish a Technical Reference Manual as soon as possible, probably early next year. This document will provide detailed information on the entire system and will include schematics. There will be a charge for it.

Summary

I have been following the trade press very closely, watching the reaction to the Personal Computer. I have been surprised at one view which seems to be shared by most writers—they say the IBM Personal Computer is not cheap.

That much is true, it's not cheap. The Sinclair ZX80/81 is cheap. The Radio Shack Color Computer is cheap. And it's true, the IBM machine has a relatively high entry level price tag. But when a careful comparison is made of machines at the entry level that includes considerations of performance, feature and function, and growth potential, it becomes clear that the IBM Personal Computer is a very cost effective choice. Its architecture should give it a long product life, and its membership in the 8086 processor family assures an upwardly compatible follow-on product. In short, it is a good choice now and a viable one for the future.

Conclusion

I'm going to buy one as soon as I can. □

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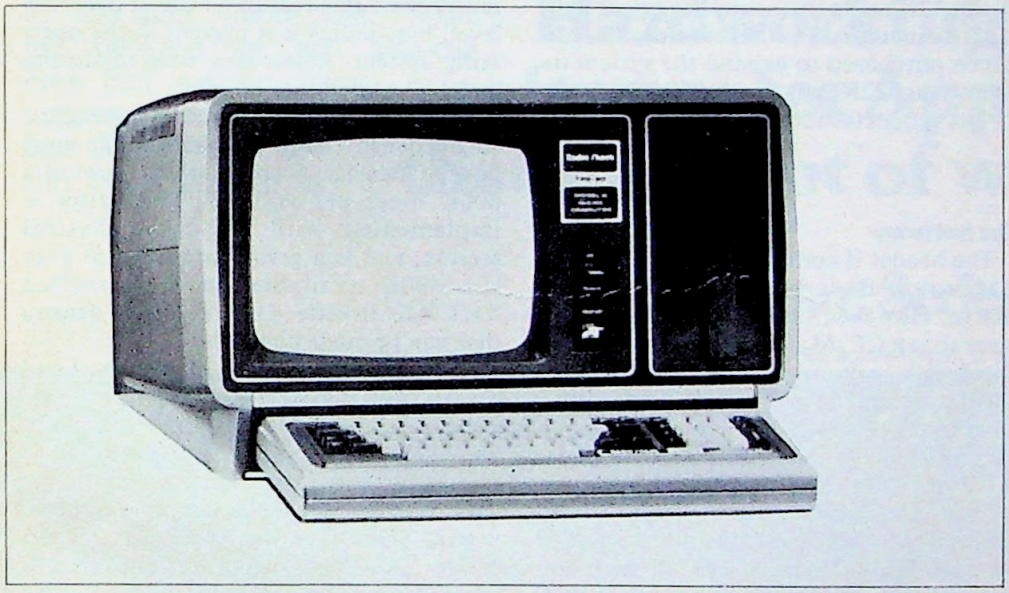
CIRCLE 106 ON READER SERVICE CARD

The TRS-80 Model II and Pickles & Trout CP/M

Andrew Klossner



Early in 1981, I needed a system on which to run CP/M version 2. My requirements included a fast Z80, a full complement of memory, large memory-mapped video display for word processing, a detachable keyboard with a good feel and upper and lower case, and an 8" floppy disk drive.

As a hardware novice, I needed service facilities. As a regular working bloke, I needed something inexpensive. My choice: a Radio Shack TRS-80 Model II, for which I paid $3499. After six months of daily system use, I have yet to regret it.

The Hardware

The design of the Model II is far better than the Radio Shack reputation led me to anticipate. It represents an excellent tradeoff between cost and features. It is also one of the first desktop computers to pay serious attention to human engineering and ergonomics.

In one package, the Model II incorporates an 80 x 24 character display and an 8" double density floppy disk drive. Inside there is a Z80 microprocessor ticking at 4 MHz, 64K of usable RAM, a Centronics printer parallel port, two RS-232 serial ports, and two real time clocks. The keyboard connects via cable. Since you pay for a single cabinet and power supply, you save a great deal over the cost of separate components, although you lose the ability to upgrade your system selectively.

External Organization

The keyboard features upper and lower case in the standard QWERTY layout. Special keys include Tab, Esc, Backspace, Break, Hold, Enter, F1, F2, and four cursor control keys. A numeric keypad lies to the right. The tilde, backslash, vertical bar, and rubout characters are typed by holding down the Ctrl key and striking "6," "9," "0," or "-." There is no way to type an accent grave; this annoying deficiency means that 127 of the 128 possible ASCII codes can be entered.

There are no "typeamatic" keys. Instead, a Repeat key is provided. Both a Lock and a Caps key are included; the former works like a typewriter Shift Lock, while the latter locks only the letters to produce all upper case. Both keys glow red when active, thanks to embedded LEDs.

The display uses a white phosphor. Warmup of the tube takes less than four seconds; it comes on before CP/M finishes booting. The character set is well designed and is pleasing to look at, with true lower case descenders. Besides blank and the standard 94 printable characters (including accent grave), there are 33 "business graphics" characters, useful mostly for margins and bar charts. Each character can be displayed in normal or reverse video.

The disk drive is mounted to the right of the display, facing the operator. My unit came with a Shugart 801 which seeks reliability at six milliseconds per track. This means that there is no meat grinder sound; head movement is whisper quiet. A disk expansion unit with up to three additional drives can be connected at the back.

The Power and Reset switches are located between the display and the disk drive. This position of the Reset key is far superior to a place on the keyboard (where it can be accidentally struck, to disastrous results) or on the back of the chassis (where you have to fumble to find it). To reset the computer, you must lift the key, so a falling object will not affect it. This is, unfortunately, not true of the Power switch, which is On when raised and Off when lowered. Power status is indicated by a red light between the two switches.

The Centronics and RS-232 connections are at the back of the chassis. After removing two screws and breaking the

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warranty seal, the cover can be pushed back and swung up and away. This is harder than it sounds; in learning the trick, which is described nowhere in the available documentation, I broke two of the four plastic pins which hold the cover flush with the back chassis wall.

Internal Organization

The system is based around a custom bus, which is designed to make full use of the Z80 family of parts. All peripheral interfaces are interrupt driven, and the disk controller is capable of performing direct memory access, so that disk I/O and computation can be overlapped. Boards are plugged into an eight-slot backplane, of which only four are used in an off-the-shelf unit.

The power supply is not extravagant; when the disk head is loaded, the display image contracts. A ventilation fan spins constantly when power is on.

The CPU board contains a Z80A, along with a DMA chip, two SIO ports, a counter/timer chip, and a 2716 ROM. The ROM is mapped into the lower 2K of memory upon power up or Reset. The bootstrap code performs extensive diagnostics, then loads the operating system from disk, which disables the ROM with an OUT instruction to leave RAM throughout the memory space.

The floppy disk controller board features a Western Digital 1791 controller chip which can manipulate single or double density disks. Although Radio Shack doesn't advertise it, the board contains all the necessary circuitry to run a double sided drive. It also has a PIO chip for the Centronics port.

The video/keyboard interface board holds an additional 2K of RAM, which can be mapped into the top 2K of memory at the flip of a bit in an I/O port. Each of the first 1920 bytes corresponds to a character position on the screen. A reverse video (black on white) character is selected by setting the high bit. A Motorola MC6845 chip drives the display and supports various sizes and speeds of blinking cursors.

This board also has a 60 Hz clock and the keyboard interface, both of which signal interrupts by pulling on the NMI (non-maskable interrupt) line.

The fourth board contains either 32K or 64K of dynamic RAM, depending upon which option you order. Bank select circuitry is provided, allowing any of up to fifteen 32K pages to occupy the upper half of active memory. Further memory boards can be purchased to expand the system to as much as 512K, but neither TRSDOS nor CP/M supports more than 64K RAM.

The Software

The Model II comes with TRSDOS and a Microsoft Basic interpreter at no extra charge. However, since I bought my computer to run CP/M, I rarely boot the Radio Shack disk.

After researching the available implementations of the CP/M operating system for the Model II, I bought CP/M version 2.2 from Pickles & Trout. The BIOS (Basic I/O System, the code which must be customized to each new machine) in this package is well thought out. It includes several practical features, while eschewing the expensive flash incorporated into CP/M by many hardware manufacturers. Contrary to published reports in some usually reliable periodicals, no hardware modification is necessary to support CP/M on the Model II, and there is no point in asking a Radio Shack dealer to install the CP/M "option."

Perhaps the most useful aspect of this software is its support of virtual disk drives. This allows a program on a single-drive machine to run as though up to four drives were on-line. When the program attempts to switch to a new drive, CP/M displays a message asking the operator to mount the appropriate disk, then waits for Enter to be typed.

Another extremely important feature is a software type-ahead buffer, which allows keystrokes to accumulate until called for. Many word processing packages also incorporate this feature at the application level, but, unless it is present in the operating system, keystrokes entered during disk I/O activity can be lost.

P&T CP/M supports both the standard single density disk format and its own double density format which provides 600K bytes per volume. This latter is implemented with 512-byte physical sectors, and is a great improvement over the 480K available on a formatted TRSDOS diskette. Only a double density disk can be made bootable.

The operating system allows the baud rate of the serial ports to be selected independently. Any of three different handshaking techniques can be specified, to allow slow devices to request a pause in the flow of data while they catch up. I connect a NEC Spinwriter and let CP/M perform XON/XOFF handshaking; the printer sends control-S to stop output, and control-Q to resume.

The console output routine in the BIOS emulates a CRT terminal by accepting characters and placing them into video memory. Control characters such as carriage return, line feed, backspace, and tab cause the standard display result. Other control codes are defined to perform functions such as clear screen, line insert/delete, toggle reverse video mode, toggle graphics mode, and direct cursor addressing. A program can also request that the video RAM be mapped in for access, allowing near-instantaneous screen update by word processors.

Besides the standard assembly language program entry to the BIOS through location 0, P&T CP/M supports an alternate entry point at location 40 through which additional services can be requested. These include configuring the I/O ports, performing serial or parallel I/O, setting and reading the time of day clock, and selecting display options such as whether lines wraparound or the cursor blinks.

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In addition to the usual utilities, P&T CP/M comes with programs to format and certify diskettes, configure I/O ports, and select disk seek rate. The IOFREEZE program allows the operator to set default attributes, which apply when the system is booted. AUTOEXEC can be used to select a command for execution upon every cold or warm boot. TRS2CPM reads a file from a TRSDOS disk. FASTCOPY copies one disk to another, and is optimized to function well with a single disk machine, where it fills all of RAM with data before asking the operator to switch disks.

The major drawback to Pickles & Trout CP/M is that the source code for the custom BIOS is not included. Even a listing would be valuable to the assembly language programmer trying to make full use of the hardware. For example, a program can request that a specific routine be given control when the counter/timer ticks, which happens 100 times per second. This routine must return via the RET instruction. There is no way to determine the contents of the user's registers at the time of the interrupt, or to modify the PC before returning, as a debugging routine might need to do.

Another problem, which may be either a hardware or software fault, is that activation of the Reset key when the disk is active does not completely reset the computer. Typically the display screen fills with garbage, the disk remains active, and subsequent use of Reset is ineffective. In these cases, the only way to recover is to power down the machine for fifteen seconds. This is especially inconvenient when a lengthy, disk I/O bound program must be halted.

For those who are handy at connecting different disk drives, P&T offer versions of CP/M which support double sided drives, for a capacity of 1.2 megabytes per volume, and versions which work with Winchester hard disk units.

Pickles & Trout CP/M represents one of the best jobs of customization in the CP/M domain.

The Documentation

The TRS-80 Model II comes with an owner's manual, which contains brief operating instructions, a TRSDOS manual, and a Basic manual. For thirty dollars you can get a technical reference manual, which is extremely complete and well written. It includes fully annotated schematics for every circuit and a separate chapter for each board and major component, as well as the manufacturers' data sheet for the LSI chips. It could be improved only by the addition of a listing of the boot ROM.

Pickles & Trout CP/M comes with the usual five manuals from Digital Research. In addition, a well written user's manual introduces the reader to CP/M and details the additional features provided by the custom BIOS.

A Personal History

When I first decided to buy a Model II, I approached the local Radio Shack Computer Center about the possibility of leasing, which they were pushing in a newspaper advertising campaign. It turns out that the lease program is intended only for businesses, not for consumers; my application was turned down.

I then did some shopping around to see what range of prices was available. All the stores that I visited which carried the Model II charged the list price of $3890. The hobbyist magazines, on the other hand, were full of ads from mail order houses with prices as low as $3400. I selected a dealer who is located within a comfortable drive of the factory in Texas and sent him my life's savings; shortly later, my new computer appeared at the local airport.

The system worked flawlessly for a month, but then began to show some flaky behavior patterns. These were characterized by a failure of the self test upon power-up or Reset.

In addition, the disk drive head began squeaking at the six milliseconds step rate,

GLOSSARY

Non-maskable interrupt—An interrupt is a signal that stops the normal program flow and causes execution of a specific vectored routine, after which control returns to the original program. Some interrupts can be disabled by setting a bit mask. A non-maskable interrupt cannot be stopped.

Controller chip—Any processor dedicated to control of a peripheral such as a disk drive.

Handshaking—Communication between a computer and peripheral or other computer, indicating whether a device is ready to send or receive data.

Wraparound—The continuation of a word from the right margin of a screen to the left margin of the next line.

Format (verb)—To place output in a predetermined form or arrangement. Also, to prepare a disk for data storage.

Source code—A program in human-readable form before compilation or assembly. Source code usually includes comments and meaningful labels.

Assembly language—A mnemonic representation of machine language. Assembly language uses op codes such as JMP (for jump) rather than the actual hex value that represents the instruction.

Register—A location in a microprocessor that is capable of holding a value. Used to load and store memory, and for internal operations.

Port—A hardware location used for input or output of information.

ASCII codes—The American Standard Code for Information Interchange, which represents alphanumeric characters and special controls as numbers.

White phosphor—The coating on the inside of a television picture tube which produces a white dot when exposed to an electron beam.

Bus—The lines connecting processors, memory, and other portions of the computer that send or receive data.

Z80/Z80A—One of the more popular microprocessor families, containing a powerful instruction set.

Interrupt driven—A device or routine that operates during interrupts.

CPU—Central processing unit. This is the microprocessor on which the computer is based.

DMA Chip—A chip which can read memory using Direct Memory Access rather than requiring information to be passed by the CPU.

Bootstrap—A routine that allows the computer to read other programs. In essence, the computer is pulling itself up by its bootstraps.

PIO chip—A chip dedicated to Programmable Input and Output.

Bank Select Circuitry—A system allowing a CPU to address more memory than it is designed for by switching between different banks of RAM.

and I had to increase it to ten and put up with the meat grinder sound.

Eventually the machine failed so completely that the power-up sequence ended with a display of garbage, and I had an opportunity to investigate Radio Shack's claim of readily available service. I took the machine to the local Computer Center for maintenance under the terms of the ninety day warranty.

This first experience with the service department was extremely frustrating. To begin, they promised to have my computer ready in 24 hours, or "48 at the outside." A week came and went while it sat unattended in the back of the repair depot despite daily telephone calls. In accordance with Murphy's Law, when they finally began to run their diagnostic package, it worked flawlessly, so they didn't bother to open the box. Eventually I retrieved it and spent the rest of the warranty period making regular impact adjustments with my shoe.

On the day that the warranty expired, a hardware-wise friend popped the cover and immediately spotted the problem. The bar which holds the boards against the backplane had too much give, and the boards were working their way out. Also, many of the socketed chips were not well seated. A bit of re-seating eliminated the flakies, and a spot of lubricating oil on the disk drive ended the squeaks. (The lubrication procedure is described in the P&T manual.) If the service technician had been at all experienced with the Model II, he would have recognized my symptoms and done this himself.

I selected a dealer and sent him my life's savings.

Several months later I had cause to return to the service department when the machine failed again. I was prepared for another nightmare, but this time I came away satisfied. There had been a complete turnover of service personnel, and the new technician diagnosed a bad disk interface board, swapped it for a good one, and made a variety of mechanical adjustments in less than two hours while I read science fiction in the front office. He also ran the P&T disk certification utility to check out the new board; TRSDOS has no analogous program. Although the computer was out of warranty and my bill was over $100 (of which $70 was for the board switch), I was happy with the experience and will not hesitate to return if another problem develops.

In all honesty, I must shoulder some of the blame for my computer's failure. For several months I used it both at home and at work, and it commuted with me. The resulting jostling was doubtless the cause of the loosened boards. The Model II is not advertised to be portable, and I have no doubt that if I had installed it in one spot and never moved it, it would not have failed.

Conclusions

The TRS-80 Model II is an excellent CP/M system for the person who is not well versed in hardware. To date, it is alone among inexpensive all-in-one units in offering a standard 8" disk drive instead of 5¼" minifloppies.

When purchasing a Model II, the buyer should ensure that the seller is an authorized Radio Shack dealer, and should get the dealer's "authorized dealer number" for presentation when obtaining service under warranty. If a Model II is bought from an unauthorized dealer, the warranty is voided.

Pickles & Trout CP/M represents one of the best jobs of customization in the CP/M domain. The resulting programming environment is head and shoulders above the more mundane efforts produced by many hardware manufacturers in support of their systems.

CP/M version 2.2 is available for $185. from Pickles & Trout, P.O. Box 1206, Goleta, CA 93017.

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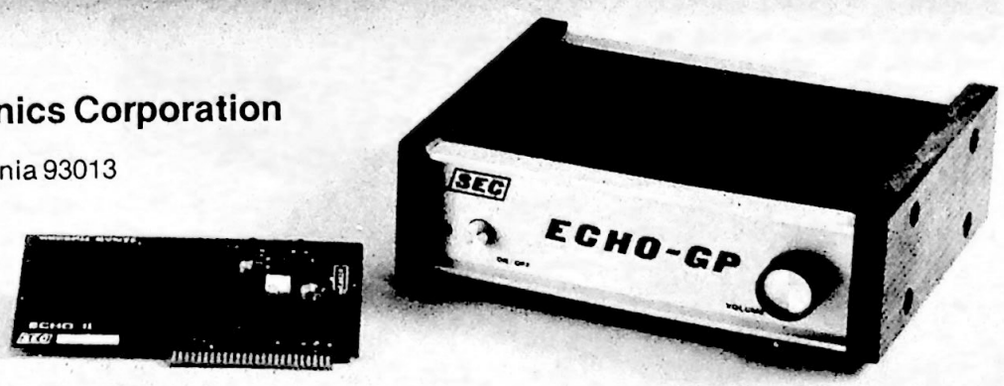
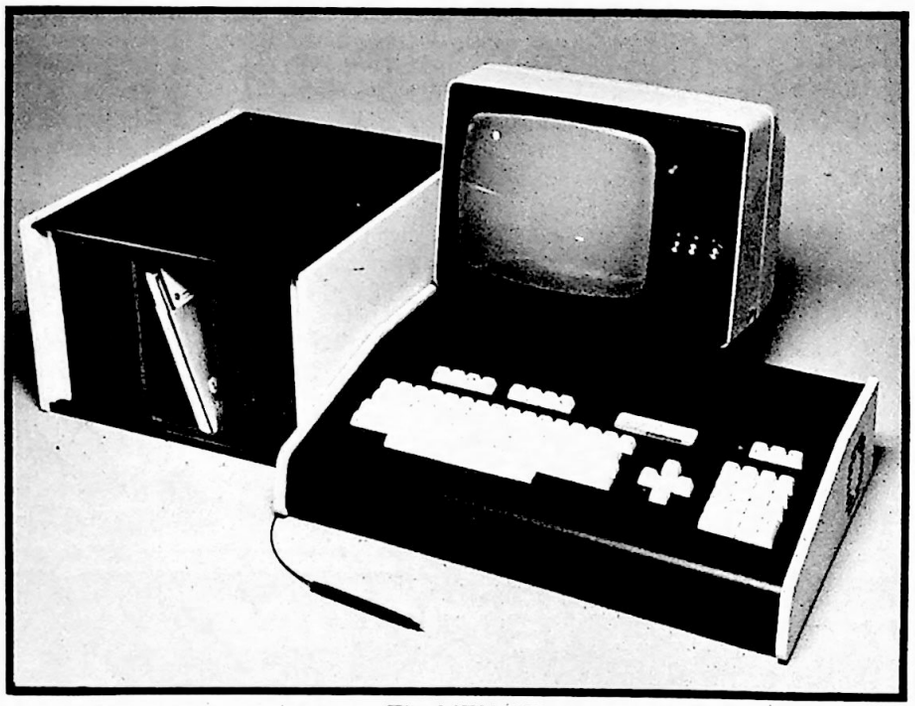


CIRCLE 186 ON READER SERVICE CARD

Graphics, Music and More

Carl Strobel



The MTU-130.

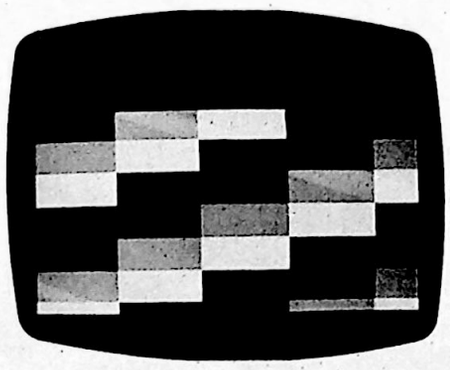
Photography by David Hornick.

When computer professionals get more excited over a new computer than the kids next door, you know the machine has to be impressive.

The computer that is receiving this kind of attention at my house could easily be the most powerful and versatile microcomputer yet offered for personal, professional and small business use. It is the MTU-130, a superb new computer just introduced by Micro Technology Unlimited, a small Raleigh, North Carolina company that up to now has specialized in developing advanced hardware and software enhancements for computers produced by other people.

If the phrase "most powerful and versatile" sound a bit extravagant, add the words "advanced design" and "expansion capacity" and a few other adjectives and take a look at what the MTU-130 offers. It will be a long look because there is a lot to see—memory capacity, quality sound and music, high resolution graphics, a disk operating system that puts many of the bigger systems to shame, Basic and assembly language programming capabilities acclaimed by my professional programmer friends.

Carl Strobel, 1716 Tarleton Way, Crofton, MD 21114.



Two shades of gray, in addition to black and white, can be created in the medium resolution mode. In this mode, the computer provides a 240 x 256 dot matrix for graphics creation.

The computer comes with 80K of system and user RAM and is easily expandable to a directly addressable 256K. If you need more memory, virtually unlimited expansion is possible through a memory bank switching capability.

High resolution graphics has been one of MTU's specialties. The MTU-130 has two graphics levels in addition to its standard 80-column, 25-line alphanumeric display. One level offers the ability to create objects on a 240 x 256 dot matrix in black, white and two shades of gray. The second level provides double that resolution through the addressing of individual pixels on a 480 x 256 pixel screen. Tne results, as shown in the accompanying photographs, are impressive, indeed.

A high definition light pen feature is standard and provides an easy means of creating graphics on the screen as well as

allowing direct user response for such things as menu selection. Programming the light pen is as simple as any other Basic programming, thanks to special commands in the extended Microsoft Basic.

Hal Chamberlin, one of the pioneers in microcomputer music, is vice president for research and development of MTU, so you could expect emphasis on a sophisticated music capability.

The MTU-130 has an 8-bit digital-to-analog converter that not only provides exceptional quality four-voice music but also allows implementation of very life-like human voice and other complex sounds in user programs. This music capability, incidentally, has been used since last fall by Ohio State University in teaching music courses. The computer music has an eight-octave range and programmable envelopes, and each of the four voices has 16 harmonics which are programmable.

The computer music has an eight-octave range and programmable envelopes.

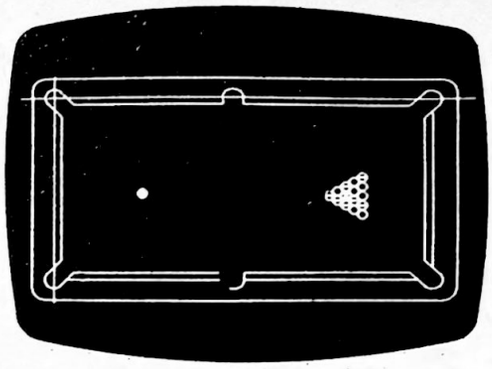
CODOS 2.0

The computer offers what is probably the most advanced disk operating system available for microcomputers. It is superior even to a well-known minicomputer system I've used. Called CODOS 2.0, or Channel-Oriented Disk Operating System, it is a more advanced version of a DOS offered by MTU for the past several years and was written by MTU's software manager, Bruce Carbrey.

CODOS merits a lengthy discussion by itself, and I shall expand on its power and subtleties more fully later. Just a quick word here to note that it offers true I/O device independence and provides a programming flexibility that has to be used to be believed. CODOS also dynamically allocates file space on disk; no need to declare to your DOS in advance how big your files are going to be—even if you know.

CODOS supports up to four double density 8" disk drives, either single or double sided or any mixture of the two types. Disk capacity is 500K bytes for single sided and 1 megabyte for double sided disks. My entire collection of game programs on cassette now resides on one side of one disk with room to spare.

Not insignificantly, the sustained data transfer rate under CODOS is 19.7K bytes per second. MTU claims, and my experience supports it, that CODOS will locate, load and begin execution of a 32K file in three seconds.



The beginning of a game of pool on the MTU-130 which combines high-resolution graphics with sound effects. The two lines which cross at the upper left pocket form the graphics cursor used in this game to specify the point at which the cue ball is aimed.

The MTU-130 is clearly designed for floppy disk operations to take advantage of the speed and power of the system. But an audio cassette port is there for those who want to use tape for input and output. With appropriate software, being developed by MTU, nearly all audio cassette formats in use by microcomputers today can be read and written through the port, making possible tape exchange between the MTU-130 and other computers.

Other I/O ports include an 8-bit parallel and an RS-232 serial port. The RS-232 port has software selectable data transfer rates from 50 to 19,200 baud with programmable data format. It offers another handy way to transfer programs or data from one machine to another, using the Download and Upload utilities in CODOS.

Local netting of the computers, which has significant educational and business applications, is also possible through an internal I/O port. Software, in conjunction with a Network Transceiver Board, will allow data communications at 50K baud.

Finally, for music enthusiasts who want greater sound fidelity than is available from the standard 3" x 5" speaker (which actually provides good quality sound), there is an output for connection to a high fidelity system.

Those ubiquitous folks at Microsoft have written a powerful, extended Basic for the machine. The interpreter is loaded from disk rather than residing in ROM which is the way the minis and mainframes work. It simplifies upgrades and the introduction of more features later on at a cost of about one second's delay while the interpreter loads. Those of us who have lived through Commodore's frequent changes to the PET ROMs can appreciate MTU's good intentions.

The concept of disk-based operating software also makes it easier to implement other languages on the MTU-130.

The Computer

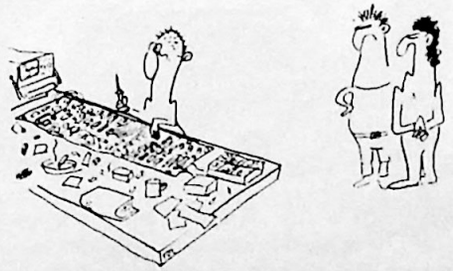
The computer itself is in a nicely styled brown and tan case 22" wide by 14" deep. A 96-key keyboard makes the case wider than that of an Apple, but it is not as high or deep. Upper and lower case letters, numbers and standard symbols are provided, along with special function and control keys. Eight user-definable function keys are at the top of the keyboard where they can easily be correlated to eight "legend" boxes on the monitor—of which more in a moment.

The MTU-130 is a 6502-based machine.

Press a key and you get an audible click through the on-board speaker; "auditory feedback" is probably the elegant name for the feature. As you might have anticipated by now, MTU has made the tone, duration and volume of the click adjustable. Simple modifications to the I/O driver software allow the user a choice—or no click at all. Admittedly, the ability to make keys click to your preference is not a key criterion in judging a computer. But to me it illustrates the thought that went into the design of the MTU-130.

A 12" green-phosphor high resolution monitor sits atop the computer case while the disk drives go on the side of the computer where they are out of the way. Both the monitor and disk drive power supply can be plugged into AC receptacles on the back of the computer case, allowing the MTU-130 power switch to control everything.

The heart of the computer is what MTU has called the Monomeg processor board. It contains the 48K of user RAM, 16K of two-port RAM for the bit-mapped video display which is the basis of the high resolution graphics capability, the I/O and sound generation logic and associated hardware, and a 6502 microprocessor with a 1 Mhz clock rate.



"Yesterday I bought a chip that does all that for 50¢."

Yes, the MTU-130 is a 6502-based machine. The company was adamant that this computer, with its highly efficient instruction set and flexible addressing codes, have the speed and power to meet personal computing needs for some time to come. MTU also points to the availability of 6502 machine language programs and programmer expertise in support of their decision.

For those who need some number crunching capability, MTU has a 68000 board in production that will share tasks with the MTU-130. Full handshaking and bidirectional interrupts allow the two processors to communicate. Initially the 68000 will be on a 128K RAM board; this will be upgraded to 512K using 256K RAM chips with the 68000 having straight addressing to all 512K. Up to three boards can be mounted inside the MTU-130.

Memory

The MTU-130 uses dynamic RAM for memory, but the display section keeps on-board RAM refreshed without introducing wait states or other types of system delays.

The exceptional quality of the high-resolution display is achieved by having each pixel addressable in bit-mapped memory. Setting the bit causes the corresponding pixel on the screen to light. The mathematics required to draw objects in high resolution gets a bit complex, but MTU's machine language software routines called by Basic commands make the process rapid and painless for the user.

In the gray scale graphics mode, shades are created combining two horizontally adjacent pixels into a single wider dot. The brighter gray scale dot is set at the same intensity as the white dot in the other mode, creating a relatively dimmer gray and a brighter white.

An 18-bit address bus on the Monomeg board supports the direct addressing of up to 256K of memory. Because the addressing techniques use the address modes of the 6502, in practice the memory is divided into 64K for programs and 64K for data. Further expansion, as mentioned earlier, is possible through use of bank selection registers.

An expansion bus, with sufficient electrical power already available on the MTU-130 as delivered, makes memory expansion a simple matter of inserting memory boards into the existing card files in the case.

Mounted above the Monomeg board is the CODOS disk controller board with 16K of read/write memory, a 256-byte bootstrap loader PROM and the disk controller circuitry.

CODOS is loaded automatically from disk into the memory on the board by the bootstrap PROM in about one second. The critical top 8K of RAM is then write-protected to prevent inadvertent crashing of the system by a user program.

CODOS loads automatically.

Don't judge the power of CODOS by the memory space it occupies. It acts like a much bigger DOS, partly because it is. It is written with 15 overlays which are moved into memory only when needed with no delays in response apparent. The other part of the power story is the fact that CODOS is written in optimized machine language.

CODOS loads automatically. Put a disk in drive 0 or power up with a disk already in the drive and the loading begins.

Once loaded the CODOS monitor assumes control and a series of commands from a job file designated "Startup" are read and executed. The Startup file initially provided with the system does the basic housekeeping needed to get the system running and concludes by asking, in a pleasantly modulated voice (there's that sound capability again) for the date. However, Startup can easily be modified by a user to perform any desired action—such as loading and executing a specific program on disk without involving the user. Totally customized operation is possible.

The automatic booting of CODOS and the possibilities of the Startup file seemed a nice convenience until I talked to Susan Semancik of the Delmarva Computer Club, which has been breaking new ground with its work in computer support for the handicapped. The club was initially interested in the MTU-130 because its fine graphics and animation capabilities lend themselves to work on sign language for the deaf. But Susan saw the automatic loading and customized operation of Startup as a boon for the severely handicapped, such as quadriplegics. A simple device to turn the MTU-130 on, such as a mouth switch, would unlock the full power of the machine.

The MTU-130 displays the company's symbol in high-resolution graphics mode, which allows individual addressing of the 122,880 pixels on the screen.

CODOS Commands

Back to the power of CODOS. It provides for several different types of facilities: there are 35 free format built-in commands, all of which are oriented to system operations, opening and closing drives for example, and manipulation and execution of machine language programs.

The ASSIGN command is at the heart of the channel-oriented DOS and the I/O device independence. What it means is that any file on disk or any I/O device can be simply assigned a channel number and then data can be moved to or from it over that channel. CODOS keeps track of the mundane details.

The system is so simple and flexible that it was actually hard for me to accept at first.

For example, under Basic program control, data can be read in from channel 5, which might be assigned to a data file on disk, and read out to channel 6, assigned to a printer. Reassign channel 6 to a modem, either through the Basic program or by a direct command, rerun the output part of the program and the same data is sent over the phone lines. Once they realize the power this capability provides, newcomers to CODOS are totally converted.

Easy manipulation of machine language files is possible through such commands as GETLOC, display load addresses of files; DUMP, display the contents of memory in both Hex and ASCII; HUNT, search for a string of bytes in memory; and TYPE, display contents of a file.

The convenience and versatility of CODOS is underlined by the way in which the TYPE command can be applied, not only for machine language programs but for a file of any type—Basic program, data or whatever.

The command TYPE XFILE will display the contents of XFILE on the monitor. TYPE XFILE P will send the contents to a line printer. TYPE XFILE YFILE:1 will write a duplicate copy of the file, renamed YFILE, on the disk in drive 1. Another example TYPE 5 ZFILE, will cause input from the device or file assigned to channel 5 to be written on disk as a file named ZFILE.

The system is so simple and flexible that it was actually hard for me to accept at first. I thought I had to be overlooking something.

As Easy As...

TRS-80 Disk & Other Mysteries

by H.C. Pennington

This book is the definitive authority on data recovery for the TRS-80 Model I disk system. In almost every case, lost data can be recovered and this book tells you how to do it. From clobbered directories to parity errors, this profusely illustrated data recovery cookbook includes examples and step-by-step instructions for both beginners and professionals.

132 pages. $22.50

Microsoft BASIC Decoded & Other Mysteries

by James Farvour

This book is the only one of its kind. You will learn how the TRS-80 Model I BASIC interpreter works from power-up to power-down. It has the complete disassembled Microsoft BASIC Level II interpreter with over 13,000 lines of detailed comments in one volume. The math, arithmetic and utility routines are fully explained with examples on how to use them. An incredible learning aid for the beginner and a valuable reference for the professional.

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by Dennis Bathory Kitsz.

A comlete hardware/software how-to-do-it like reverse video, high res graphics, audible keystrokes, 8-track mass storage music synthesizer, and real time clock. Dozens of project hints, tips, and fixes complete with the interface software. If you are a beginner, there are chapters on wire-wrap, soldering and construction methods. If you are a professional, there is a wealth of technical detail.

332 pages. $29.95

BASIC Faster and Better & Other Mysteries

by Lewis Rosenfelder

BASIC is not nearly as slow as you think! This book shows you how to make it faster and better with techniques and tricks that you never dreamed of for Model I, II and III disk systems. You won't find trivial, poorly designed "checkbook" programs here – only useful BASIC techniques and code ready for use in YOUR programs. Tutorial for the beginner, instructive for the advanced, and invaluable for the professional. All routines are available on disk.

290 pages. $29.95

Learn about your TRS-80 computer – it's as easy as 1-2-3-4. These books are easy to read and understand because they are written for you by people just like you. Here are answers and solutions without jargon. There are no end of chapter "tests" – no incomprehensible math formulas – no textbook explanations – just straightforward, plain English.

You will learn how to recover "lost data" on disk, how the BASIC interpreter works, how to make BASIC run faster and better, and how to modify and interface your TRS-80. In other words, you will learn how to make your computer do all the things you want it to do. It's as easy as 1-2-3-4.

Available at computer stores, B. Dalton Booksellers and independent book dealers. **BASIC Faster and Better** is also available at all RADIO SHACK Computer Centers and selected RADIO SHACK stores. (Cat. No. 62-1002) If your dealer is out of stock, order direct. Include $4.00 for shipping and handling. Foreign residents add $11.00 plus purchase price, in U.S. funds.

TRS-80 trademark TANDY Corp

CIRCLE 145 ON READER SERVICE CARD

JJG

1953 West
11th Street
Upland, CA
91786

WILL SOMEONE PLEASE TELL

ACCOUNTING

Account Keeper
Accounting Plus II
Accounting Plus II Bit Package
Accounts Receivable
Accounts Receivable Balance Forward
Accounts Receivable/Sales Analysis
ACS Basic Accounting System
AMI Client Write-Up
Asset Record System
B/F Accounts Receivable System
Billings Management
Bookkeeper II General Ledger
Bookkeeper II-Depreciation
BPI General Ledger
Business Accounting
Business Check Register and Budget
Business Control System
C.P.A.
Client Accounting System
Construction Accounting
CPA Client Write-Up
Datawrite Client Write-Up System
Delivery Service Automation
Depreciation Calculations and Reports
Executive Accounting System
Financial and Management Accounting
Financial Partner
Fixed Asset Accounting
Fixed Asset Depreciation
Fixed Assets/Depreciation Schedules
Fund Accounting System
General Accounting
General Accounting Package
General Ledger
Glector
Insoft Accountant System
Integrated Accounting System
IRAP
Ledger System Business Module
Management – Financial Reporting
MAXILEDGER
Microaccountant Accounting System
MICROLEDGER
MJA Multi-Journal Accounting
Nominal Ledger
One-Type Accounting System I
One-Type Payroll and Accounting
Paysystem Accountant
Peachtree General Ledger
SBCS General Ledger
SNIP – Integrated Accounting
TCS Accounting
TCS Client Ledger
TCS General Ledger
TCS Total Ledger
The Accountant Finance Data Base
The Bookkeeper System
The Boss Financial Accounting
The Business Bookkeeping System
The Controller
The Depreciation Planner
The Software Fitness Program

AGRICULTURE

Adjusted Weaning Weights
BEEFUP-Herd Management Performance
Cattle Feeding Economics
Corn Harvest Losses
Corn vs. an Alternate Crop
Cow-Calf Profitability
Crop Yields
Economics of Corn Production
Farm Management
Farrow-To-Finish Swine Production
Feeder Pig Production
Fertilizer Formulation
Field Population
Field Size
Finishing Feeder Pigs
Job Cost (Crop Cost)
Least Cost Fertilizer Application
Liming Soil
Liquid Manure and Fertilizer
Net Energy for Feedlot Cattle
PEDIGREE-5 Generation Annotated Pedigree
Protein Balancing for Feedlot Cattle
SBCS Agri-Ledger
Selling Wet Corn vs. Dry
Sheep Production Economics
Soil Erosion
Soybean Harvest Losses
Swine Ration Analysis
Swine Ration Formulation

APPLICATION PROGRAM DEVELOPMENT AIDS

A-FORTH
ABT Pascal Tools
APEX-6502 Assembly Language
Apple-80 Disassembler
Assembly Language Development System
AUDEX-Audio Programming Aid
CBASIC Program Maintenance Utilities
CINDEX
Cosapple 1802 Disassembler
CRTFORM Programmer Productivity
Diagnostics II
DISTEL-Disk Based Disassembler
Executive Planning System
Floating Point Dictionary
Forms 2
Key Perfect-Checksum Table Generator
Linkdisk-Disk Utility for Apple Pascal
Linkvideo-Screen Utility
Lower Case Character Generator
MULISP/MUSTAR-80
OGI-Forth-Implementation of FIG-Forth
Pascal Programmer
Pascal Level 1
Pearl III-Rapid Logic Generator
Personal Programmer
Prism/Ads Data Base Generator
Program Development System I
Program Writer for Non-Programmers
Programming Aids 3 3
Quic-N-Easy Application Development
RAID-Real Time Assembly Debugger
Scientific Data Base
SID-Symbolic Instruction Debugger
Stok Pilot-Menu Generator
STRING-80
STRING-BIT
Systems Analyst
Teacher Plus Teaching & Reference Pkg
The BASIC Teacher
The Last One-Program Generator Pkg
The Toolbox Programming Utilities
Tiny-C-Interactive Programming
UCSD Pascal
Unlock Development Tool
V-COM Disassembler Package
Z8000 Cross Assembler

BUSINESS MANAGEMENT TOOLS

Analyst-Business Productivity
Apple Sack General Business Program
Bookkeeper II-Sales Analysis
Business Pac 100
Business Planner
Creative Financial Package
Desktop/Plan
Execuplan Planning & Forecast
Financial Modeling System
Financial Planning Series
Financial Planning/Analysis
Finplan/Financial Planning
FP2020 Financial Planner
FPL-Financial Planning Language
Magic Worksheet
Magicalc-Forecasting Package
Micro-DSS/Finance
Microfinesse-Financial Modeling
Milestone-Critical Path Network Analysis
Optimiser
PFS-Personal Filing System
Personal Report System
Plan 80-Financial Planning & Analysis
Project Boss-Mgr's Cost Control System
Project Planning and Budgeting
Retail Purchasing & Pricing
Salary Planner
Senior Analyst
Supercalc-Electronic Spread Sheet
Support Pkg for Real Estate Mgmt
T/Maker II-Visual Calculating Tool
The Analyzer
The Budget Planner
Universal Business Machine Planning and Forecasting
VisiCalc III
VisiCalc Real Estate Template

CAPITAL PROJECTS PLANNING & CONTROL

Angle Project Scheduling
APM-Project Management System
Jobtrak-Project Tracking
Milestone Project Management
Project Management System
Project Planning

COMMUNICATIONS

Apple·Access III
BISYNC-80
BSTAM
Class Data Recorder
CM-900 Burroughs Network Services
Communications Program
Crosstalk Smart Terminal/File Transfer
Data Capture 4 0
Data Transporter Package
Datalink
DTS-3-Serial Data Transfer
Electronic Mail
IBM-CP/M Allows Transfer of Data
IE/Modem
Intercom Communications
METTY-Intelligent Terminal Package
Micro-Courier
Micro-Telegram
Microlink-80-File Transfer Program
Reformatter-CP/M-IBM Data Transfer
Remote Console Program
Smarterm-CP/M Terminal Program
Term II-Computer Intercommunications
Term Intercommunications Package
TTY-Communications With Other Computers
U-Net-Shared Resources Network
Ultimate Transfer
Visiterm-Communications Program
VT-100 Emulator
Western Union Interface

DATA MANAGEMENT

ANALYST
CBS-Configurable Business System
CCA Data Mgt System
CM 2020 Configurable Manager
Condor Series 20
Data Management Program
Data Manager
Data Master
Data-View Electronic Filing Cabinet
Database II
Database Management
Datafax
Dataflow-Info Processing
Datastar
Datastore
Datatree
Disk-Edit-Screen Oriented Disk Editor
DMS-Data Mgmt System
FABS II-Rapid Keyed Access
Fast Entry for Tabs Business Modules
FINDAFYL-Reference Retrieval System
FMS 80-Data Base Management System
GBS Database
General Database
HDBS-Hierarchial Data Base
IFO Database Manager
Information File Organizer
Information Master-Data Mgmt System
KTDS-Key to Disk, Data Entry
Linkindex-Pascal Utility
MAG/Base-Data Base Management
Manager-Relational Data Base
MDBS DRS-Micro Database Mgt System
MUMPS-Language for CP/M Database
Optimum Data Mgmt Program
PRISM/IMS-Information Mgt System
RADAR-Random Access Data Acquisition
Reprogrammable Data Base
Scientist-Data Base & Statistical Pkg
Selector III-Data Base Processor
Selector IV-Data Base Mgt
Selector IV-Key Access Info
Selector V-Data Base Mgmt
STATPRD-Integrated Database System
Stoneware Utility Package
Super Kram II – Multi-Keyed Random Access
The Reprogrammable Data Base Program
VisiDex-Data Base Mgt System
VisiFile-Data Base Mgt Package
Whatsit?-Conversational Query/Retrieval

DATA SECURITY SYSTEMS

Absolute Security
Encode/Decode Security System

DISTRIBUTION

ABT Retail Manager
Beer Distributor Management
Inventory Order Entry Invoicing
Oil Jobber Management System
Order Entry and Inventory Control
The Store Manager
Wholesale/Retail Distribution System

EDUCATION – BUSINESS

Accounting Tutor
Comparative Buying
Income Meets Expenses
Interactive Typing Tutor
Job Readiness-Assessment & Development
Mastertype-Typing Instruction
Money Mgmt Assessment
Typing
Typing Tutor
You Can Bank On It-Bank Concepts

EDUCATION – CHEM/PHYSICS

Acid-Based Chemistry
Atomic Structure
Chem Lab Simulation
Chemical Equilibrium
Chemistry With A Computer
Fundamental Skills for General Chemistry
High School Chemistry
High School/Jr. College C.A.I. Biology
High School/Jr. College C.A.I. Physics
Organic Nomenclature
Physics

EDUCATION – ENGLISH

A Batch of Endings
Agreement of Pronoun/Antecedent
Alphabetize
Capitalization
Catalog Cards
Commas
Compu-Read
Compu-Spell
Coordination
End Marks
Excess Words
Faulty Coordination
Hearing the Homonyms
Irregular Verbs
Is It "ie or ei?"
Language Drill
Locate Books on the Shelf
Magic Spells
Misplaced Modifiers
Parallel Structure
Possessing the Possessives
Prefixes & Suffixes
Quotations
Reading Level
Readings In Literature
Run On Sentences
Scramble
Sentence Diagramming
Sentence Fragments
Speedreader
Spell-N-Time
Spelling Bee with Reading Primer
Spelling Those Plurals
Still More Nasty Demons
Subject/Verb Agreement
Subordination
The End of the Endings
Those Nasty Demons
Understand the Card Catalog
Understand the Title Page
Use an Index
Use the Table of Contents
Using Adjectives/Adverbs Correctly
Word Scrambler & Super Speller

EDUCATION – MATH

Addition & Subtraction
Algebra I
Basic Math Skills
Compu Math Arithmetic Skills
Compu-Math Decimals
Compu-Math Fractions
Counting Bee
Decimal Estimation
Division Drill
Drill II
Elementary Math
Fractions
Geometry
Geometry and Measurement Drill
Lessons in Algebra
Matching and Using Numbers
Matching Geometric Figures
Math-Addition & Subtraction
Matrix Mathematics Package
Measurements
Multiplication & Division
Mumath-PO Symbolic Math
New Subtraction
Numerical Analysis Mathematics
Problem Solving
Problem Solving in Everyday Math
Sets
Sign Drill/Typing
Statistical Analysis I Mathematics
Statistics 3.0
Typing Fractions

EDUCATION – MISC.

2ES Courseware
American History Through Biographies
American Indians
Antonyms
Apple Sack 2 Home Education
Approximate Measure
Astronomy I & II
Concentration-Taxing
Counting Calories
Early Civilization
Educational Package
Educator's Disk
Family Fun
Farm and Farm Products
HI-Res Life
History
Home Safe Home
Insects
Light Pen Quiz
Literature
Living Things
Math, Sports, Etc.
Middle Ages
Money
Moptown
Mother Goose Rhymes
Music/Art
Our Bodies
Poison Proof Your Home
Questions & Answers in Biology
Questions & Answers in History
Quizstat
Reverse/Sampling
School Days
Sentence Beginning
Shore Features
Sound
Supermap
Synonyms
Systems of the Body
Teacher Create Series
Teacher Plus
Telling Time
The Basic Teacher Pac
The Earth and It's Composition
The Professional-Teaching Program
The Solar System
Transportation History
Typing
United States
Visual Perception Tests
Weather Fronts
Work Relationships
World Desert Region
World Polar Regions

FINANCE-INVESTMENT & PORTFOLIO ANALYSIS

Analysis 1-Stock Trend Data Analysis
Commoapx System
Computicker
Computrac File Reader
Dow Jones News & Quotes Reporter
Dow Jones Portfolio Evaluator
Dowlog-MC
Electronic Stock Package
Engineer's System For Trading
Forecast I
Forecast II
Fotofolio-Visual Display w/ Statistics
Gann's Square of Nine Analysis
Intelligent Investor
Investment Analysis
Market Charter-Technical Analysis
Moneybee-Investment Analyst
Options 80-Stock Options Analyzer
Portfolio Master
Quotecharter
Quoteprocessor
Ratorm-Investment Analysis
Stock and Options Analysis
Stock Forecasting
Stock Market Management
Stock Market Utility
Stock Option Analysis
Stock Tracker
Stock Valuation Program
Stocksheets
Strategy M-Monitor Price Change Dynamics
The Clover Method Trading System
The Stock Portfolio Program
Tickertec-Tickertape Program
Wilers 6 Systems Analysis

FOREIGN LANGUAGES

Chinese Lessons
Foreign Words and Phrases
Greek Roots and Prefixes
Japanese Lessons
Latin Roots and Prefixes
The French Hangman
The Russian Disk
The Spanish Hangman

GAMES

Adventures
Alien Rain
Alien Typhoon
Almanac – The Time Machine
Amaze
Analiza
Animal
Anti-Ballistic Missile
Apple Adventure
Apple Bowl
Apple Fun
Apple Panic
Apple Sack 3 – Adventure Pak
Apple Sack 7 – Space Sack
Apple Sack 8 – Game Sack
Apple Sack 9 – Base Star
Apple Stellar Invaders
Apple-oids
Asteron
Astro-Scope
Astrology
Autobahn
Backgammon 20
Battle of Midway
Beer Run
Best of Muse
Biorythms
Blackjack
Both Barrels
Brands
Bridge 2.0
Bridge Tutor
Bubbles, Planetoids and Burnout
Cartels and Cutthroats
Castle Wolfenstein
Chambers of Xenobia
Chebychev 1
Chebychev 2
Chronicles of Osgroth
Civil War
Compu-Math Arithmetic
Compu-Math Decimals
Compu-Math Fractions
Computer Air Combat
Computer Baseball
Computer Bismark
Computer Conflict
Computer Napoleonics
Computer Quarterback
Cops and Robbers
Cosmo Mission
County Carnival
Cyber Strike
Disk Talker
Dr. Chips
Dragon Fire
Dungeon
Executive Fitness
Falcons
Fantasyland 2041
Fastgammon
Flight Simulator
Galactic Attack
Galactic Wars
Galaxy Wars
Games People Play
Gamma Goblins
Gobbler
Golf/Cross-Out
Gorgon
Hammurabi
Head On Game
Hellfire Warrior
Hi-Res Football
Hi-Res Soccer
In The Army Now
Into Ships
Jet Fighter Pilot
Klondike 2000
Lost By Ship
Mastermind
Meteoroids in Space
Micro Othello
Mimic
Mind Games Package
Mission Asteroids
Mystery House
Need an Analyst
Nominoes Jigsaw
Oil Tycoon
Olympic Decathlon
Operation Apocalypse
Orbitron
Outpost
Paddle Fun
Pegasus II
Perception 3.0
Phantoms Five
Planetoids
Plot 3D
Pokeno
Poker Slot Machine
Pool 1.5
Pot 'O Gold I
Pot 'O Gold II
President Elect
Pro Football
Pro Picks
Project Omega
Pulsar II
Race For Midnight
Raster Blaster
Red Baron
Rendezvous
Robot Wars
Sahara Warriors
Sargon II (Chess)
Satellite Trak
Shell Games
Shuffleboard
Skybombers
Skybombers II
Sneakers
Snoggle
Soft Porn
Softside Publications
Space Eggs
Space Warrior
Spellguard
Spelling Bee
Star Cruiser
Star Dance
Star Thief
Startraders
Startrek
Stock
Sub Attack
Tawala's Last Redoubt
Teacher's Pet
Temple of Apshai
Terrorist
Tetrad
The Strip
The Asteroid Field
The Great Escape
The Horse Selector II
The Prisoner
The Scorekeeper
The Shattered Alliance
The Warp Factor
Three Mile Island
Torpedo Fire
Ultima
Voyage of the Valkyrie
War and Games
War Games
Warp Factor
Watch Your Moves
Win at the Races
World's Greatest Blackjack
Wumpus
Xplode

ME WHAT AN APPLE CAN DO?

GRAPHICS/ COMPUTER-AIDED DESIGN

3-D Surface Plotter Package
A2-3D1 Graphics Family
ABT Barward Software
Action Sounds & Hi-Res Scrolling
Apple Plot
AppleGraphics II
Artist Designer
Bar Chart (Histogram) Graphics
Business Graphics III
Circuit Designer Graphics
Circuit Simulator
Creativity Tool Box
CURVFIT
Data Plot
E-Z DRAW
FLGDZINE
Graforth — Development Tool
Graph-Fit
Graph-Pak
GRAPHPOWER
Hi-Res Secrets
Line Graphics
MC Painting
ORIFICE
Pascal Animation Tools
Pascal Graphics Editor
Perspective Plot — 3-D Graphics
PGE — Graphics Editing Package
PILOT Animation Toolkit
Polar Coordinate Plot
RGL Real Time Graphic System
Screen Director
Shape Table Generator
Stats-graph
Super Shape Draw & Animate
Tablet Graphics
The Coloring Board Program
The Designer
Topographic Mapping
Ultra Plot
Utopia Graphics Tablet System
VACVESL — Vacuum Vessel Design
VESDZINE — Design of Vessels
VISITREND/VISIPLOT
XY Vector Plot Package

HOME MANAGEMENT

Address File
Auto Records
Checkbook Balancing
Checking Account Management
Chequemate
Diet Analysis
Financial Analyzer
Five Minute Financial Check-Up
Grocery List
Home Finance
Home Inventory File
Home Money Minder
Home Purchase Analysis
Magazine File
Mortgage Analysis
Personal Accounting System I
Personal Expense Record
Personal Finance Manager
Personal Financial Planning
Programmed Exercise
The Personal Check Manager

INCOME TAX

Dow Jones Portfolio Evaluator
Individual Tax Planner
Micro-Tax Individual Tax Package
Micro-Tax Integrated State Income Tax
Micro-Tax Partnership Package
SHORTAX — Tax Planning Package
Tax Planner
Tax Preparer
TRPS — Tax Return Preparation System

INVENTORY CONTROL

ARM-1000 — Rental Business
Basic Business Inventory
Bill of Materials
BPI Inventory Control
Intotory Inventory System
Inventory Accounting
Inventory Control
Inventory Management
Inventory Management for Stock Control
Inventory Pac
Inventory System Business Module
Manufacturing Inventory Control
MATSTAT-Materials Tracking
Order Entry/Inventory Control
Peachtree Inventory System
Point-Of-Sale Retail System
Property Manager for Moveable Equipment
Retail Inventory
Rogis Stock Control for Components
Stock Control
Stock Recording
Stockfile Inventory System
Stockroom Inventory and Purchasing
Structured Systems Inventory Control
TCS Inventory Management
The Order Scheduler

JOB & CONTRACT COST ACCOUNTING

Billflow
Bookkeeper II-Job Costing
BPI Job Costing
Contract Billing
Contractor Job Cost
Cost Accountant
Job Accounting System
Job Control System
Job Cost Accounting
Project Cost Accounting for Architects
Project Cost Accounting for Engineers
The Software Fitness Job Cost Analyst
Time Recording-Job Cost Analyst
Timerec-Transaction Carry Forward

MAILING LIST & LABEL PROCESSING

Address Book Mailing List
Apple III Mail List Manager
Apple Mail Sack
Apple Post
Benchmark Mail List
Commercial Mailer
Mail List
Mail80 Mailing List Software
MAILER-Name & Address Management System
Mailing Address
Mailing List Package
Mailing System
MAILMERGE
MAILPRO
Mailroom-Mailing List Management
Master Mailing List
NAD-Name & Address Selection System
Name And Address
Postmaster-Mail Management
Professional Mailout
School Mailer
Small Business Mailing & Filing
Super-M-List Mailing List Program
Ultra Plot/Mailing & Filing System I

MARKETING/SALES ANALYSIS

EASYTRAK-Salesmen Monitoring Package
Marketing Systems — Proposal Developer
Office and Agent Productivity Package
Sales Analysis
Sales Pro Prospect Mgt Package
Sales Tracker
SALESLOG — Sales Mgt Program
SNAP — Questionnaire Design and Printing
TCD Life Insurance Computer System

MISCELLANEOUS

BILL — Building Energy Use
Circuit Analysis
Hand Holding BASIC
Insulate
Mini-Warehouse System
Stepwise Multiple Regression

MUSIC

Alpha Syntauri Music Synthesizer
Apple Music Theory
Apple Sack Music & Graphics
Appleodion Music Synthesis System
Music System
Musicomp
The Electric Duet

ORDER ENTRY/ ACCOUNTS RECEIVABLE

BPI Accounts Receivable Program
Cash Receipts System
Company Sales
Invoice Compiler
Invoicing
Membership Billing
MICROREC
Multi-Property Accounts Receivable
Open Item Accounts Receivable
Order Entry
Order Entry and Billing
Order Entry and Invoicing
Order Tracking System
Peachtree Accounts Receivable
Peachtree Sales Invoicing
Progressive Billing
Purchase Order System
Receivables System Business Module
Receiver
Sales Invoicing
Sales Ledger
Sales Order Processing
Software Fitness Program — A/R System
Structured Systems Accounts Receivable
T-SOP Sales Order Processing
TCS Accounts Receivable Package
TCS Total Receivables
The Biller

PAYROLL PROCESSING

Advanced Payroll Package
After-The-Fact-Payroll — updates records
Apple Payroll System
Bookkeeper II-Payroll
BPI Payroll
Business Basic Payroll System
Contractor Payroll
Jobcost Payroll
Micropayroll
Passive Payroll
Paymaster
Paymaster-Payroll System
Payrecord I
Payroll
Payroll Accounting Package
Payroll Assistant
Payroll I
PeachPay
Piece Rate Payroll System
Post Facto Payroll
Print/Paycheck Accounting System
Run Time Payroll Program
Sheltered Workshop Reporting
Structured Systems Group Payroll
TCS Payroll Package
TCS Total Payroll
Variable Worker's Compensation
WH-347-Accessory program for Jobcost

PERSONNEL MANAGEMENT

AMI Post-Facto Payroll
MICROPERS — Payroll & Personnel Mgmt
Personnel Data Recorder
Personnel Office — Federal Compliance
Personnel Record
Personnel Record/ Employee Records System

PROFESSIONAL OFFICE SYSTEMS

AMI Omegabyte Time & Billing
BETA — Stand Alone Time & Billing System
Billkeeper — Professional Billing
Client Billing System
Client Record/ Bill Preparation
Datalaw System 3-Law Office Mgmt
DataTime
Dental 80A-Dental Acctng & Billing
Dental Billing Package
Dental Office Management
DentalEase
Dentistaid — Dentist Office Management
Insyst (Insurance System)
Legal Billing & Timekeeping System
Legal Clerk — Office Management System
Legal Time Accounting System
Medicaid Day Treatment
Medical Accounting and Billing
Medical Clinic
Medical II — Office Mgmt System
Medical Office Management
Medical Secretary
Medical/ Dental Management System
Medical/ Manager
MedicalEase
MedPak
Medtips — Billing & Insurance Forms
PAS — 3-Patient Billing & Accts Receivable
Patient Accounting System
PIP-Payroll/ Invoicing Program
Professional Office Management
Professional Time & Billing
PTA — Professional Time Accounting Pkg
Series 8000 Dental Mgmt
Series 8000 Medical Mgmt
Series 9000 Family Dental Management
The Patient Scheduler
Timeclok
Timemaster — Time Accounting
Timesaver Client Billing System

PROGRAMMING LANGUAGES

Ada Compiler
APL/ V80 Language
Apple III Business Basic
Apple III Pascal
Apple FORTRAN
Apple Logo
Apple PILOT
ASM 65-Assembler
BASIC A+ — Extended Business Basic
BASIC Compiler
BASIC-80
BASIC/ Z — Native Code Compiler
BD Software "C" Compiler
C Compiler
CBASIC 2 Compiler
CIS COBOL
COBOL 80
Cos Assembler
Cos COBOL
Focal 65-High Level Programming
Forth 86
Forth-Language Compiler
FORTRAN 80
FORTRAN IV
Hand Holding BASIC
KBASIC — Microsoft Disk Extended BASIC
Language System with Apple Pascal
LISP-80 Compiler
MAC 8080 Macro Assembler
MULISP Compiler
MULISP/MUSTAR 80
muMath/muSimp 80-High Level Programming
Nevada COBOL Compiler
Pascal Compiler
Pascal/ M86
Pascal/ MT+With SPP-ISO Standard
PL/1-80-Programming Language
RATFOR — FORTRAN Language
S-BASIC
SSS FORTRAN Compiler
Softronics
Stiff Upper Lisp
TCL Disk BASIC Interpreter
TCL-Pascal
TEC 65-Editing Language
Tiny BASIC High-Level Language
Tiny C
Tiny Pascal
Tiny-C-Two Compiler
Transforth II
UCSD Pascal
Whitesmith's Compiler
XPLO-Structured Language
XY BASIC Interactive Process Control

PROGRAMMING UTILITIES

Apple Sak 4 — Utility Package
Basic Utility Disk
Disk Utilities 3
Disk Utility Package
Disk-o-Tape-Pascal
DOS Tool Kit
File Maintenance Package
MAG/Sam Keyed File Mgmt System
MAG/Sort-Record Sort/
Masterdisk-disk Sector Editor
MSORT — for COBOL 80
Pascal Utility Library
Pascal — Sort Program
PSORT — Pascal File Sorting
QSORT — Sort/Merge Program
SORT/B — Hybrid Sort
Supersort
Ultrasort

PURCHASING/ACCOUNTS PAYABLE

Accounting Payable
Accounts Payable Business Module
Accounts Payable/ Purchase Order
Bookkeeper II — Accounts Payable
Cash Disbursements Posting System
Check Writer
Company Purchases
Contractor Accounts Payable
Disk-O-Check
Micropay-Accounts Payable
Print Check Accounting System
Purchase Ledger
Structured Systems Group Accts Payable
T-POP — Purchase Order Processing

REAL ESTATE

American Software Property Management
Apartment Building Investment Analysis
Apartment Manager
Commercial Property System
Construction Cost/ Profit Analysis
Cornwall Apartment Management
Income Property Analysis
Listings
Multi-Property Accounting System
Office/Apartment Real Estate Management
Property Analysis System
Property Management
Property Management System
Property Mgmt — G/L Tenant and Expenses
Real Estate Analysis Program
Real Estate Analyzer
Realty Package
Rent vs. Buy
Rental Manager
Residential Property Management
Tax Deferred Exchange Model
Tenant Processing Package
The Landlord-Property Mgmt System
VisiCalc Real Estate Templates

TIME MANAGEMENT & SCHEDULING

Agenda Files
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Color Calendar Package
Datebook Appointment Calendar
Datebook Time Management System
GUARDIAN — Computerized Scheduling
Office Manager — Staff Appointments
Personal Datebook
Professional Secretary
PROSCHED — Project Schedule
Time Manager

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Apple Writer III
Benchmark — Word Processing System
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Letter Master — Basic Word Processor
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Secretary — Word Processing
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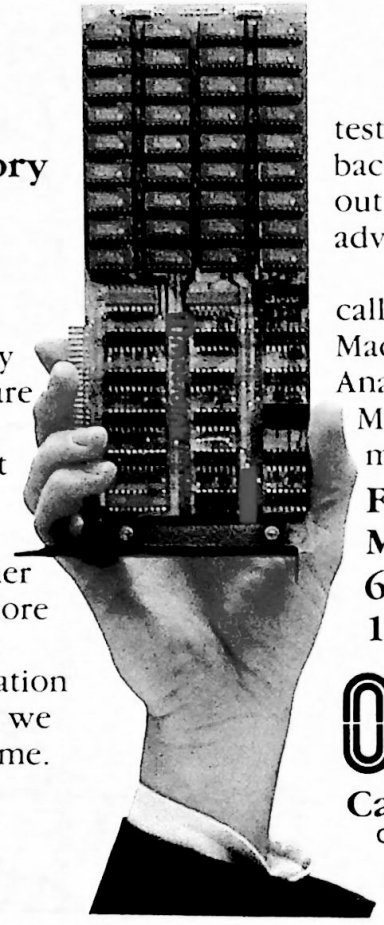

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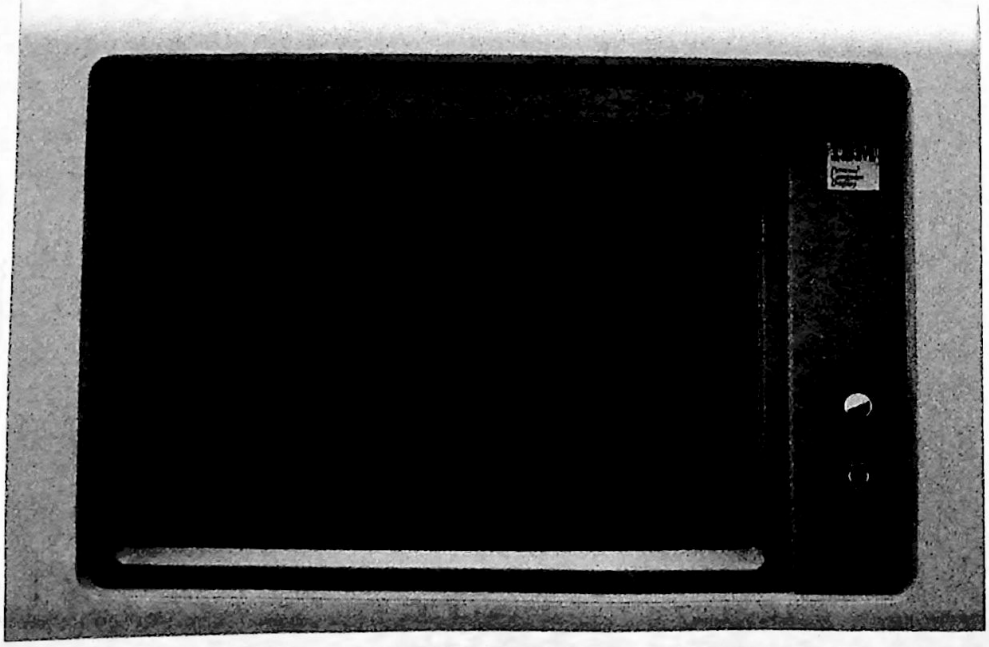


Software protection against inadvertent deletion of files is provided by LOCK, with UNLOCK making them vulnerable again. RESAVE allows an updated file to replace an older version on the disk. The dynamic file space management of CODOS even allows new files to be larger than the originals; CODOS allocates the additional space as needed. Incidentally, the only maximum limit to file size is that of the disk capacity—500K bytes for single sided and 1 megabyte for double sided.

One feature that long-time disk users have liked is the fact that files do not have to be OPENed or CLOSEd. Only the disk drives need that care.

If the user can't find a CODOS command to his liking, he can create his own. Simply SAVE a machine language program that performs whatever function is needed and the name of the program becomes the CODOS user-defined command. The flexibility of the system is evident everywhere.

CODOS also includes utilities which allow for formatting new disks, copying all or specified files and deleting files. BACKUP is a particularly handy method for duplicating all files on a given disk at high speed.

Two utilities allow users to identify permanently to CODOS the specific configurations of their systems. SYSGENDISK is used to define number of disks, disk drive track-to-track step time and head load time if they are changed from the as-shipped version. SYSGENDEVICE probably gets greater use; with it up to six I/O devices can be added as standard system components, and devices can be deleted or their characteristics modified.

Machine language programmers on the MTU-130 can get mainframe-style support with Supervisor Call instructions, a powerful tool found on many large computers. The SVCs allow programmers to call 30 different subroutines. They are far easier to use and more powerful than a Call Subroutine (JSR in 6502 mnemonics) for several reasons.

The SVCs are address independent, and preserve the value of the machine registers (no saving and then restoring the values when going to a subroutine through an SVC). They are a tremendous aid to program debugging. An error which occurs during the processing of an SVC automatically aborts the program, generates an error message explaining the problem, displays the address of the SVC and records the value of all registers.

Reliability

A few words about the reliability of disk operations with CODOS. Long after many of my friends were boasting of loading speeds with their floppy disk drives I was still wedded to cassette tapes. Their complaints about disk crashes and loss of data, combined with my own experiences on a minicomputer system, led me to choose the slow but reliable magnetic tape.

I am still waiting to report my first crash.

After more than a month of intensive use of CODOS and the Shugart SA801 drives that came with the system, I am still waiting to report my first crash. I have been reasonable, but not fanatic, about environmental controls. The MTU-130 sits in an otherwise unused bedroom where no smoking is allowed and which I dust and vacuum on occasion. But a constant stream of visitors, including my short-haired cat who has penetrated my defenses on at least two occasions and left behind an ample supply of hair, has made the environment less than pristine.

I can't give any data on mean time between crashes or data errors per 1000 disk accesses simply because there haven't been any.

For those who use the MTU-130 in an even less controlled environment than mine, it's worth noting that both the computer case and the disk drive case have positive pressure ventilation—the internal fans suck air in from the outside—which makes filtering a simple task.

Another CODOS feature that supports data recording reliability is an option under the FORMAT command used to write timing information on new blank disks. CODOS will check the disk for bad sections and automatically bypass them in allocating file space.

Extended Basic

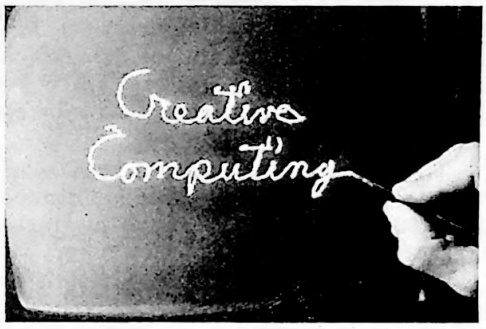
I have already mentioned the extended Basic that is standard with the MTU-130. It has several extra commands designed specifically for the computer.

It bears a close resemblance to Commodore Basic, even to the use of the "?" symbol as a shorthand for the PRINT command. It includes PEEK and POKE, and the handy Microsoft string function commands LEFT$, RIGHT$, MID$, CHR$, ASC, VAL, and LEN. The standard arithmetic and trig functions are also included.

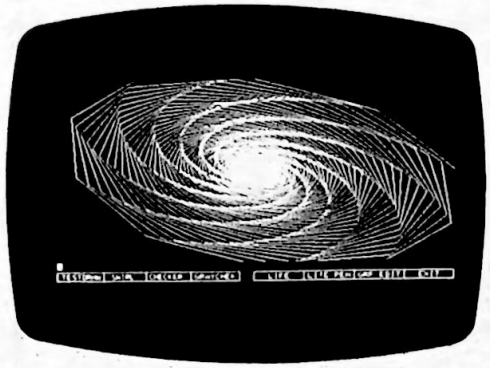
Expanded commands include BYE, to exit Basic and reenter the CODOS monitor and TONE, which allows Basic program control over the pitch, waveform and volume of sound generated by the CB2 signal on the parallel output port.

ENTER loads a Basic program in ASCII from a file or device which can then be SAVEd in tokenized MTU Basic. LIST outputs in ASCII format from the machine to a file. These commands make programs more transportable between the MTU and other computers.

OUTCHAN provides I/O independence in Basic by directing output to any previously designated channel as in the CODOS discussion above.



The name of a popular computer magazine is written on the screen using the light pen capability. The screen was first made all white and the light pen used to turn off pixels, creating a pattern in black. Reversing the video produced the image shown here.



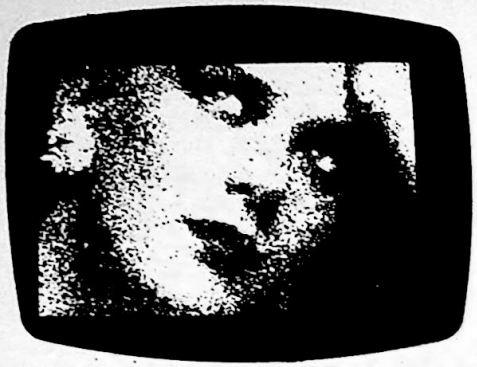
A sample of MTU-130 high-resolution graphics. The boxes, or "legends," at the bottom of the screen give the names of routines which can be called by pressing the corresponding user-defined function key.

I mentioned the eight function keys at the top of the MTU-130 keyboard and their relation to the "legend" boxes on the monitor screen. These boxes can display menu information or any other data that a user might have to choose among for input.

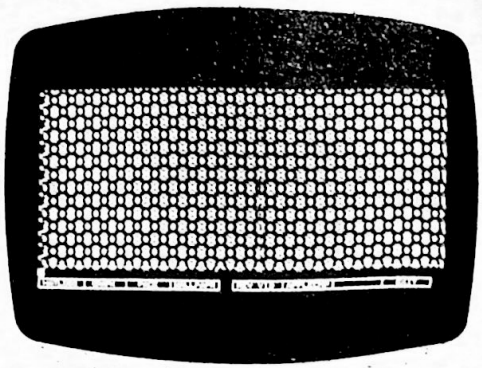
One simple example of their utility and the Basic commands that support them was in a simple program using the light pen in creating logic circuits. The LEGEND command, followed by the appropriate labels, printed the names of the logic gates in the "legend" boxes on the screen. By pressing the function key under the appropriate box, I selected the gate to display on the screen where the light pen was pointed.

KEY is used in an ON KEY GOTO ... or ON KEY GOSUB ... command where the KEY value ranges from 1 to 8.

The LIB command adds additional power to the Basic by linking in a designated library of additional specialized Basic



A digitized photograph often demonstrated on the Apple. Shown here in close up, the picture occupies less than half the MTU-130 screen while providing the same detail as the full-screen Apple presentation.



A simple repetitive pattern shows the capability of the MTU-130 for advanced graphics. This is from the demonstration program provided with the computer.

commands. Three such libraries come with the system, the IGL (Integer Graphics Library), VGL (Virtual Graphics Library) and CIL (CODOS Interface Library). Asked why these powerful extensions to MTU Basic weren't included in the Basic itself, MTU had a reasonable answer. Since they are for specialized applications, the decision was made to free up memory space for general use by allowing them to be linked in only if needed.

IGL supports simple graphics by allowing a user to draw lines (solid or dashed according to your specifications) and make use of the light pen.

The light pen command, SLTPEN, is simple to use. It recovers the x and y coordinates of the position of the pen on the screen and sets a flag when this is accomplished. The command checks for the light for 1/60th of a second so a simple loop keeps the pen checking until it sees the light and sets the flag. Use the TONE command and you get an audible signal when the action is completed.

IGL provides the ability to LABEL drawings with textual information. A visible graphics cursor can be moved around the screen to aid in drawing by determining the x and y coordinates of a given point.

VGL is a more powerful library that includes the IGL commands and adds a few of its own. Most notable is the ability to define a WINDOW and a VIEWPORT. The WINDOW allows graphics display of data using any reference system for measuring x and y coordinates by setting their range. Scaling, in effect, can be done by the program. Any values beyond the range are clipped, as though the lines were actually being viewed through a physical window. VIEWPORT establishes that physical part of the screen where the window will exist.

The third library supplied with the computer, CIL, provides a set of CODOS disk operating commands callable from the Basic program. If the one required isn't there, SYSTEM followed by the CODOS command will make it part of the program.

For ease in machine language programming, MTU-supplied software also includes a two-pass resident assembler which accepts assembly language source programs and outputs source code and listings with error messages and a symbol table and cross reference map. It is a fast and elegant operation according to an experienced programmer who has experimented with it.

MTU-130 Technical Specifications

CPU	MOS 6502, 1 MHz
Memory	80K dynamic RAM (48K user, 16K display, 16K DOS), expandable to 256K direct addressable
Keyboard	96 keys including alphanumeric, calculator display, cursor controls, 8 user-defined keys, Interrupt/Reset
Screen	12" high-resolution green phosphor
Graphics	80-column, 25-line alphanumeric, gray scale graphics on 240 x 256 dot matrix, black and white graphics on 480 x 256 matrix
I/O	Two 8-bit parallel ports, 6522 chip (one internal port); RS-232 serial; cassette interface; video out; audio out
Sound	8-bit analog-to-digital converter, 1 watt amplifier, 3" x 5" speaker, volume control
Light Pen	Plus or minus two pixel resolution, 1/60 second digitizing speed
Language	Extended Basic interpreter loaded from disk, three libraries
DOS	Channel-Oriented Disk Operating System (CODOS 2.0)
Assembler	Two-pass assembler

Summary

One thing rare for a new machine is the total lack of critical comment I have received from other users. Pressed to say something less than laudatory, I could only come up with the complaint that on-screen editing of programs, prior to their storage on disk, is not as good as that of the PET. But few computers are. Lines in programs, for example, cannot be changed by typing over errors and hitting Return. Programs retrieved from memory, as well as text and other files, can be edited very efficiently with a resident Editor program.

In summary, the MTU-130 is a powerful machine. The cost, which no doubt puts it out of reach of the casual or first time buyer is a bargain considering the capabilities of the machine. Prices for the system, which includes the computer, monitor, CODOS, Basic and the libraries, are $2999 with one single sided disk drive, $3599 for a double sided drive, and $5248 for two double sided drives.

No matter how well designed or powerful a computer is, however, there are two key questions which must be considered when evaluating it.

Are there any bugs lurking in the machine that would make the glowing technical specifications meaningless? How much software will there be to support the computer?

Anticipating the first question MTU has carried out a testing program that may well be unique for personal computers. A group of experienced microcomputer owners across the country and in Canada, with backgrounds in such key areas as 6502 assembly language programming, graphics and computer music tested the machine for several months. They provided weekly feedback to MTU engineers. Apart from a few minor or improbable problems

(simultaneously pressing the Mod, Reset and Interrupt keys would cause the system to crash) the computer received outstanding marks.

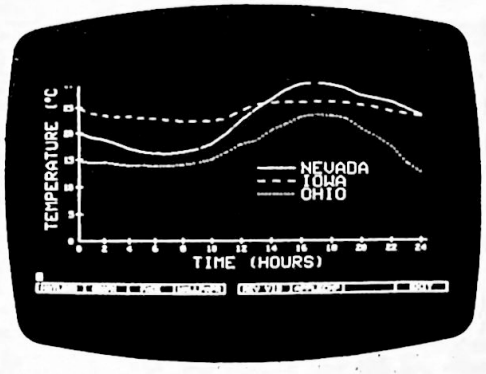
Software

Software development always presents a chicken-and-egg question. No one wants to spend time writing first rate programs unless a large market exists, but the market won't develop unless there is software support for the computer.

Some impressive software, music composition and graphics packages, for example, are already available from MTU's earlier projects. Software development houses are also working on supporting programs, according to David Cox, president of MTU. Among the projects is a compiler for COMAL, a structured programming language that has gained popularity in Europe for business applications.

Another project is rumored to be a Visicalc-like program with expanded applications and more flexible formats.

One feature of the MTU-130 should attract software vendors—a unique software protection feature that allows authorized users to make copies but helps protect software from piracy. MTU would program a unique user number into systems needed for a user, such as high school or university, who planned to purchase software on a use license basis. Only those systems with the proper user number would be able to use the software.



A simple graph drawn with the MTU-130 graphics software enhancement to Basic.

Similarly, a unique vendor number can be assigned to companies buying directly from MTU and selling a customized system to a specific market.

Two user groups have already been formed for the MTU-130, one by MTU itself which plans a quarterly newsletter, which will be free to MTU owners for the first year. The other group is an independent one formed by Jack Brown of Saturn Software Ltd., Delta, BC V4C 5Y9 Canada. Jack is also developing a version of Forth for the machine.

The MTU-130 is an exciting machine which has an exciting future. □

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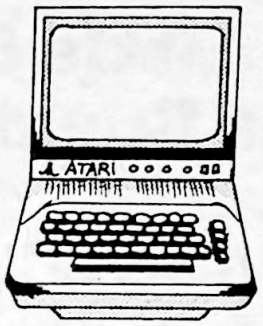

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The Little Computer That Could

Glenn A. Hart

The computer business is very much a land of opportunity. Major advances in technology arrive with startling rapidity. Combined with tremendous demand in both the consumer and business sectors, the result is an alluring siren that draws a large number of new ventures.

There are so many such companies that there is even a jargon word for them: "start-ups." There is just the slightest touch of skepticism implied in the phrase; many, if not most, such operations announce exciting new products but ultimately can't deliver any at all or quickly fail through under-capitalization, design problems or simple mismanagement.

When Adam Osborne, a transplanted Englishman known primarily as a writer and industry pundit, announced his own start-up hardware firm to produce a full-featured portable CP/M computer with an impressive array of software at an unbelievable retail price, it is an understatement to say that there were a few doubters.

As we'll see, Osborne has delivered everything he promised and then some. The result is an excellent and different computer, an impressively well-run company with unique policies and fine prospects for the future.

The Osborne I doesn't offer any real revolutionary breakthroughs. It is much more an evolution and refinement of existing techniques used elsewhere, packaged in a very new way.

Glenn A. Hart, 51 Church Road, Monsey, NY 10901.

It employs a standard Z-80 microprocessor, 64K of dynamic RAM, various I/O for peripherals, a video monitor, and two 5 1/4" floppy disk drives. These specifications could easily describe many microcomputers, although in each area there are little wrinkles of sophistication which we will examine shortly.

The 5" monitor is clearly the most controversial aspect of the machine.

The remarkable thing is that all this is completely portable! A very sturdy molded plastic case that is a dead ringer for a portable sewing machine houses everything mentioned above. When the case is sealed it is weather resistant and sized to fit under an airline seat. Releasing two latches opens the case, allowing the main unit to sit on the edge of the keyboard to form a compact and neat work station.

The full-sized keyboard has a more or less standard layout with a numeric keypad and a few extra keys for cursor movement and other special functions. Feel is quite good, better than many microcomputers, although not quite up to some expensive stand alone terminals.

The Osborne uses what they refer to as three banks of memory, although these are not the normal banks used in some S-100 systems. The first bank is the normal 64K of dynamic RAM. The top 4K is used for memory-mapped video display, leaving 60K for the CP/M BIOS and BDOS/CCP. Memory mapping provides very fast screen update and allows direct manipulation of screen characters with some sacrifice of memory space.

The second bank holds 4K of ROM which takes control when the system is first turned on. The ROM contains disk booting routines, diagnostics, and I/O, video, disk, keyboard and port drivers. The code in the ROM is something of an extension to CP/M; some of the code which would normally be in the CP/M software is stored in ROM instead.

Also in bank 2 is the memory-mapped I/O area. Almost all normal CP/M systems use what is called port-mapped I/O, meaning that information is passed to and from devices through one of the 256 input/output ports supported by an 8080 or Z-80. The Osborne uses chips from the 6800 family (specifically a 6850 and a 6821) which require that data be written to memory locations instead of to I/O ports. This may seem rather strange to CP/M types, but S-50 users will feel right at home.

The balance of the second memory bank mirrors or shadows the base bank and therefore isn't available for any constructive use. The third bank is unused except for the top 4K. One bit of each byte in this area is used as a video attribute to control underlining of each character.

Video Display

Video is displayed on the 5" monitor, which is clearly the most controversial aspect of the machine. Unlike most serious

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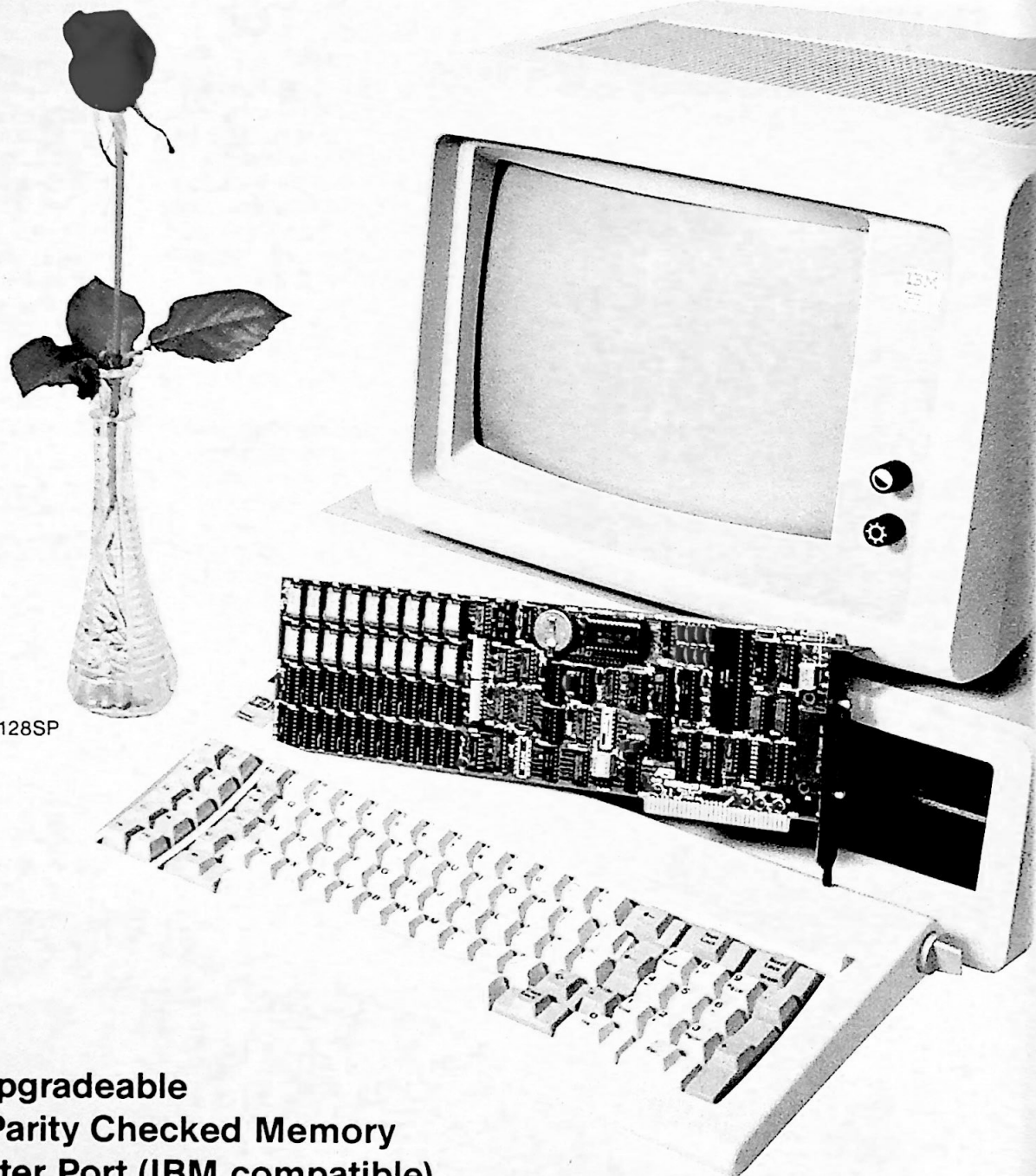

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monitors, which usually display 24 lines of 80 characters each, the Osborne screen shows 24 lines of only 52 characters each. This is thirty-five percent fewer characters than you would find on a standard screen, but over 20% more than the 16 x 64 screens still used on some computers and much more than an Apple II and other small computers which use TV sets as their display media.

The characters are very sharp and well defined, with full upper and lower case with descenders. The only deviation from a normal font is the lower case m, which is a smaller version of an uppercase letter to avoid blurring.

The Osborne I actually maintains a much larger 32 line by 128 character video area in internal memory; the hardware permits scrolling around in this area with the cursor movement keys in some modes of operation.

Full underlining and half intensity are available, as are 32 block graphics characters useful in forms design. A connector on the computer can drive an external video monitor of any size, which certainly eliminates the small screen size problem but also destroys the portability advantages which are the Osborne's main claim to fame. The external monitor displays exactly the same 24 by 52 format of the built-in screen.

The two built-in disk drives are another source of dispute. While they work perfectly and are quiet and reliable, disk capacity is limited to only 102 kilobytes each, and of this only 92K is available for program and/or data storage under CP/M. This is sufficient for a surprising amount of serious work, but many CP/M applications require far more storage capacity.

Interfacing

The Osborne I really shines in interfacing provisions. A standard RS-232 serial port is provided which can run at 300 or 1200 baud (600 or 2400 with an internal jumper change). The supplied software implements several handshaking protocols if necessary, including ETX/ACK, XON/XOFF, etc. This port is fully bi-directional and can also be used to interface an external console, transfer programs and data to an external computer, etc.

A separate modem port, which uses a nine-pin connector, is provided. Osborne will be releasing a custom modem designed to use this port, but it is not difficult to configure a normal acoustic or direct connect modem to match the Osborne I.

A full IEEE 488 port is also included, which is most unusual indeed. This port can be configured to provide the standard Centronics parallel printer protocol as well, so almost any type of printer can be accommodated. There is a wide variety of devices which have been interfaced to the IEEE bus, including hard disks, modems, printers and laboratory equipment, so the ability of the Osborne to interface with the outside world is essentially unlimited.

The final connector is for a forthcoming battery pack which will allow the computer to operate up to two hours without any access to AC power. A car adapter will also be included to run the unit from an auto battery.

The combined hardware/software of the Osborne I is a bargain.

Software

The Osborne I is, indeed, supplied with the wealth of software claimed. It is hard to believe that such a comprehensive assortment can be provided at the price of the total package; the combined list prices of the software are reasonably close to the Osborne's retail price of $1795. It is almost like getting the computer free! Of course the software included is available at significant discounts, but the combined hardware/software of the Osborne I is, nevertheless, a bargain.

The computer is supplied with a complete implementation of CP/M version 2. All the standard utilities are provided, including ASM, ED, MOVCPM, PIP, STAT, FORMAT, etc. Unfortunately, Osborne does not include a listing of the BIOS, so user modifications and patches are difficult or impossible.

Osborne has announced a technical manual which will include the BIOS listing. As partial compensation, an excellent setup utility is provided which automatically configures the BIOS for the type of printer drivers desired, baud rates and other parameters. The program allows assigning strings to the number keys 0 through 9 such that a control-1, for example, will output whatever string the user has pre-programmed for that key. Thus the Osborne computer has an even more flexible function key design than terminals with actual function keys.

The FORMAT program also serves as a full disk fast copy utility, and features a very good screen display to let the user know what is happening as formatting or copying proceeds.

When the CP/M disk is booted, an excellent help menu appears rather than CP/M itself (see Figure 1). Selecting a letter displays a screen of explanatory text describing a machine feature or giving instructions on the purpose and operation of software. This is a great help to first time users.

The commercial programs are the Microsoft Basic interpreter, the CBasic pseudo-compiler, Sorcim's excellent Supercalc spread sheet program and WordStar with MailMerge for word processing.

The Basics are the current versions and are not customized for the Osborne in any way.

Supercalc has been partially configured for the Osborne; some messages don't fit the screen window.

The WordStar provided is version 2.26 rather than the new 3.0. This is due to a conflict in the horizontal scrolling provision of WordStar 3.0 with the routines built in to the Osborne's hardware. Since the only

Figure 1.

```
                        Initial Help Menu

press A...CP/M Assembler          N...MailMerge
      B...CBASIC                  O...Osborne Utilities
      C...CP/M Commands           P...Printers/Printing
      D...Diskette Handling       Q...Quitting Each Day
      E...File Extensions         R...The RESET Button
      F...Filenames               S...SuperCalc
      G...Graphics                T...Testing
      H...Programming Hints       U...CP/M Utilities
      I...I/O Ports               V...External Video
      J...Just Starting?          W...WordStar
      K...Control Keys            X...Accessories
      L...Layout of Memory        Y...Modem Connection
      M...Microsoft BASIC         Z...Self Portrait

Press any LETTER key to receive help on a subject.
Press the ESCAPE key (labeled "ESC") to run CP/M.
```

other important new feature in 3.0 is block operations on column groups rather than lines of text, the 3.0 may be provided in the future after some software modifications.

All the software is first rate and works perfectly on the Osborne. With the limited storage capacity of the floppy disks, WordStar consumes most of a disk and some of the other packages eat up a lot of disk space as well. All this means is that the program disks almost always use the left drive while user files and applications use the right one. There is ample room for many applications, although WordStar users must be quite careful in monitoring the size of their files.

Company Policies

Any new computer almost certainly has some design problems and bugs. The Osborne was no exception, although most of the problems were relatively minor. What is exceptional is the approach Osborne took in the past and continues to take to solve problems and improve the performance of their system.

When the normal difficulties arose with early units, Osborne made arrangements to make *free* upgrades to the keyboard, ROMs and software. Users merely had to bring their units to a dealer for no charge replacement and upgrade.

This is quite unusual, with most companies offering improvements at perhaps a lower cost than normal, but almost always charging for such major upgrades. Similarly, documentation upgrades are being provided at no charge to all registered owners.

Speaking of documentation, the Osborne I deserves special commendation in this area. The computer is supplied with very comprehensive explanations of its internal hardware and software design, including all the pinouts for the interface connectors and complete software examples on how to access video and I/O memory addresses, how to drive the interfaces and many other useful and informative tidbits of information.

Complete documentation for all the applications software is also provided; in some cases this closely mirrors that provided by the software authors, while some of the manuals have been rewritten by Osborne.

While the original documentation was very good, Osborne wasn't completely satisfied. They hired one of the best microcomputer writers around, Thom Hogan, to rewrite everything. The new version is even better and more informative, and maintains a nicely conversational tone even while discussing highly technical subjects. Both tutorial and reference sections are provided, for a total of more than over 500 pages.

Osborne's marketing philosophy aims the Model I at business executives and other non-technical types. This explains their omission of the BIOS code in the documentation provided to all users; they prefer to produce relatively "turn-key" systems which can be field configured by users or, at worst, by their dealers.

Osborne is making arrangements with various software houses for Osborne itself to market many desirable software packages directly, allowing the company to maintain full control over the hardware/software interface. While outside vendors have already begun to market software for the Osborne I, few hardware companies have made peripherals available as yet.

Osborne's marketing philosophy aims the Model I at business executives and other non-technical types.

Osborne will be addressing some of the shortcomings of the machine in the near future. A double density upgrade is due for release around the time you read this article. This modification will permit 200K to be stored on each drive at a cost of around $200 for the dealer installed retrofit. There are many 5 1/4" drives which store much more than this, usually through a combination of higher track density and/or double sided drives, but Osborne states that such mechanisms do not yet meet their standards of reliability, especially with the jostling a portable unit receives.

Work is also proceeding on a 24 by 80 video presentation. This upgrade will involve a complete swap of the single board computer and will also include the double density option and expanded communication capabilities at a cost of approximately $600.

Other new products include the battery pack/car adapter mentioned earlier and a full-function 300-baud modem which will fit in the disk storage compartment and require some internal modifications. Cost for the battery pack will be about $225, including communication software.

"We have a computerized toilet, and it's really nice—unless you have to go and the computer is down!..."

Evaluation

I have a bit of a confession to make. When *Creative Computing* called to ask me to review the Osborne I, I was rather reluctant to do so. My personal system lists for about $30,000 and includes large capacity hard disk, three printers, plotting, many sophisticated special purpose boards and many other goodies.

I fully expected to feel constrained by the limitations of the portable unit. I had heard of the difficulties some users had with the small screen size and limited disk capacity and, all in all, I wasn't sure I could provide an objective evaluation of the unit.

Well, my actual reaction is just about completely the opposite. The little Osborne I has won me over almost completely. Besides being immensely "cute" and a real startler to those who see it for the first time, the unit has worked flawlessly and done everything it claims to do.

I have lugged it around to friends' houses, taken it on weekend trips and, more important, carried it back and forth to work. It worked perfectly the first time in driving several different printers with differing interface and protocol requirements, allowing me to use it for word processing and spread sheet forecasting.

I am certainly not blind to its limitations, but I have been able to perform a tremendous amount of useful work on the Osborne I which would otherwise have been difficult or impossible under certain circumstances. It is a very useful extension of my big system, and will be even more so when some of the new upgrades and peripherals become available.

In many respects, I think the Osborne I is a far more capable computer than many of the small micros widely used today, even without color graphics and the other bells and whistles available on some other units.

As either the primary computer for business executives or as a second computer for CP/M users, the Osborne I is a fine choice. The only problem I have now is that *Creative* thinks I'm giving the Osborne I back to them. No way! They'll have to come and drag it away from me!

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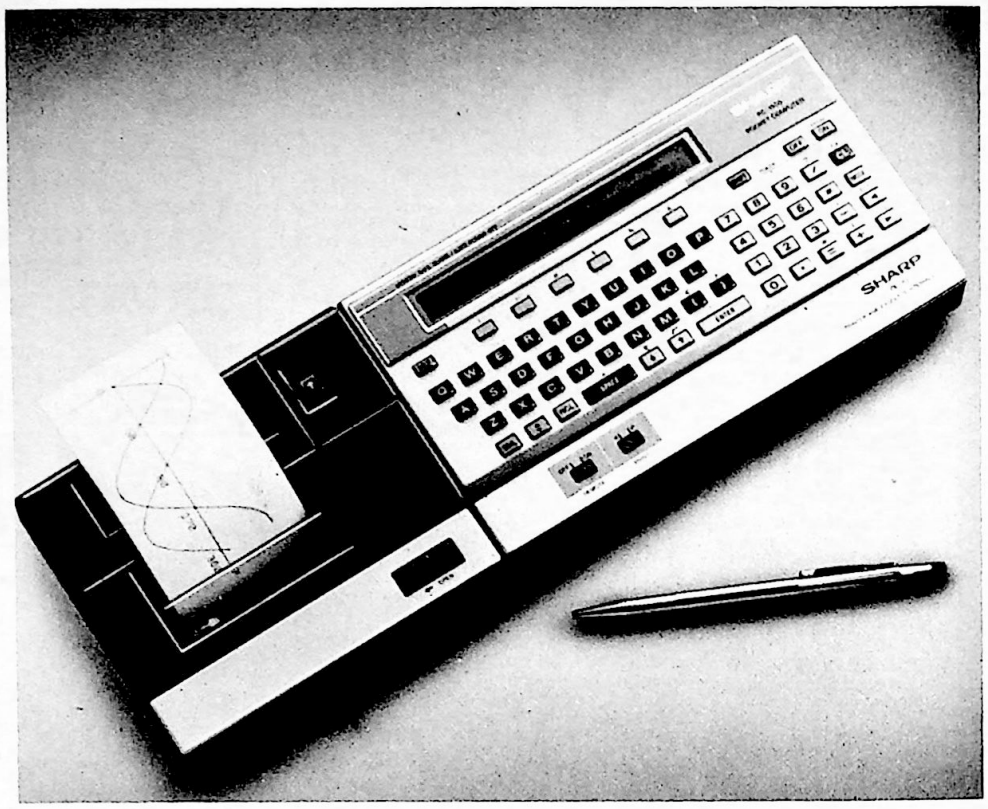
CIRCLE 126 ON READER SERVICE CARD

Pocket Programming

Glenn A. Hart



It seems like only a few months ago I was raving about the then new Radio Shack Pocket Computer. I was thrilled to be able to carry around a device that I could program in minutes using Basic rather than the hours of arcane assembly-like programming required by programmable calculators.

Storing programs on cassettes under computer control, a battery operated printer for hard copy and many other features made the Pocket Computer a breakthrough product. I computed several million dollars of inventories, did some reasonably sophisticated corporate analysis and took great delight in whipping the little devil out at meetings and quickly solving knotty problems with a few lines of Basic code.

For all of this, the Pocket Computer was not without its deficiencies and problems. The Basic interpreter was missing several useful statements and commands, string handling was either limited or non-existent, cassette storage was slow and sometimes a bit less than totally reliable and, most annoying, operation was slow. There was nothing significant enough to detract from the utility and pleasure I obtained, but it was disconcerting nonetheless.

Now Sharp (the suppliers of the earlier Pocket Computer to Radio Shack and marketers of the unit under their own model number PC-1211) has introduced a second generation version known as the PC-1500. Radio Shack also offers the new unit as their PC-2. Sharp's literature headlines the PC-1500 as "a new, upgraded Pocket Computer with expanded capacity and greater convenience," and their description is totally apt.

Sharp has taken full advantage of the extra ROM capacity to enhance the Basic interpreter with many new instructions.

Not only have most of the weaknesses of the PC-1500 been remedied, Sharp has given us some new goodies that make the PC-1500 one of the *neatest*, and at the same time, most useful, devices around.

Hardware Specifications

The 1500 is somewhat larger than the earlier unit, measuring 7 11/16" x 1" x 3-3/8", and at about 13 ounces is also a bit heavier. This is at least partially caused by the use of four AA penlight cells as the power source, rather than the small, camera-type batteries used in the PC-1.

The 1500 batteries are rated for only 50 hours use instead of 300 hours for the older unit. Incredibly, the *original* batteries are still happily driving my PC-1 after what I would guess are *many* more hours then the rating, so perhaps the same will be true of the new computer.

An AC adapter that can power the 1500 directly is available with the printer/cassette interface, which also powers the PC when the two units are combined. As with the earlier model, power shuts off after a few minutes of non-use, and programs and data are retained in memory when the computer is off.

The 1500 central processor is an 8-bit device of low power CMOS design which runs at 1.3 MHz. It is *much* faster than the CPU in the older design. The new computer also has significantly more internal memory, with 16K of ROM to store the Basic interpreter and operating system and 3.5K of RAM. The organization of the RAM is different, with 900 bytes reserved for the system and 2.6K available for the user—624 bytes permanently allocated to variable storage, 1850 bytes as the Basic program/data area and

Glenn A. Hart, 51 Church Road, Monsey, NY 10952.

Table 1. Basic Commands — PC-1211 vs. PC-1500.

I. PC-1211 Instructions Available on the PC-1500

1. Functions

ABS	ACS	ASN	ATN	COS
DEG	DMS	EXP	INT	LOG
LN	PI	SGN	SIN	SQ. RT.
TAN				

2. Statements

AREAD	CLEAR	DEGREE	END	FOR-TO-STEP
GOSUB	GOTO	GRAD	IF	INPUT
LET	MEM	NEXT	PAUSE	PRINT
RADIAN	REM	RETURN	STOP	THEN
USING				

3. Commands

CONT	LIST	NEW	RUN

4. Cassette Commands

CHAIN	CLOAD?	CLOAD	CSAVE	INPUT#
PRINT#				

II. Commands Unique to the PC-1500

1. Functions

AND	ASC	CHR$	INKEY$	LEFT$
LEN	MID$	NOT	OR	POINT
RIGHT$	RND	STATUS	STR$	TIME
VAL				

2. Statements

ARUN	BEEP	CLS	CURSOR	GCURSOR
GPRINT	DATA	DIM	LOCK	ON ERROR
ON GOSUB	ON GOTO	POINT	RANDOM	READ
RESTORE	TRON	TROFF	UNLOCK	WAIT

3. Cassette Instructions

MERGE	RMT OFF	RMT ON

4. Printer Instructions

COLOR	CSIZE	GCCURSOR	GLCURSOR	GPRINT
GRAPH	LCURSOR	LF	LINE	LLIST
LPRINT	RLINE	ROTATE	SORGN	TAB
TEST	TEXT			

188 bytes designated for reserve. While this extra memory is certainly welcome, the big news is the ability to increase RAM with an external memory module which plugs into the bottom of the PC. Two such modules are currently available, the 4K CE-151 and the 8K CE-151 retailing for $75 and $150 respectively.

Sharp has taken full advantage of the extra ROM capacity to enhance the Basic interpreter with many new instructions. Table 1 compares the statements and commands available in the PC-1211 and PC-1500. Among the many new features are two-letter variable names, two-dimensional arrays, full string handling functions, up to 80-character strings compared to the stingy seven characters available in the PC-1, logical functions, ASCII conversion functions, a built-in time-of-day clock, computer GOTO and GOSUBs, error trapping, execution tracing, READ/DATA/RESTORE for data storage and access from within a program, random number generation, merging of programs from cassette and a host of commands to control the new graphics plotter/printer we'll talk about more later.

The 1500 uses a single line liquid crystal display outwardly similar to that in the PC-1. The new unit actually has several enhancements. The "screen" is composed of a 7 x 156 point array, each dot of which is individually addressable in Basic. This flexibility allows display of 26 characters in both upper and lower case as well as special characters and a wide variety of graphics characters of the user's design. The Basic interpreter can control the dot array easily, and several interesting application programs are provided to demonstrate "screen" graphics.

The keyboard of the 1500 is laid out in the standard QWERTY typewriter configuration. The offsets between rows of keys are maintained, which makes the keyboard feel more comfortable to a experienced typist. While too small for real touch typing, a pretty close simulation is possible. For some reason, the Radio Shack PC-2 version lines up all the keys in perfect horizontal and vertical rows and is clearly more difficult to use.

Above the alphabetic keys is a row of six function keys which normally emit punctuation characters. The 1500 allows these keys to be programmed with any string of the user's choice, including other characters. Three separate groups of such definitions can be stored and readily accessed, so there is a close approximation of 18 function keys. The default punctuation characters chosen by Sharp are not the most useful, especially since frequently used characters like the comma, semicolon and colon normally require two keystrokes. Reprogramming

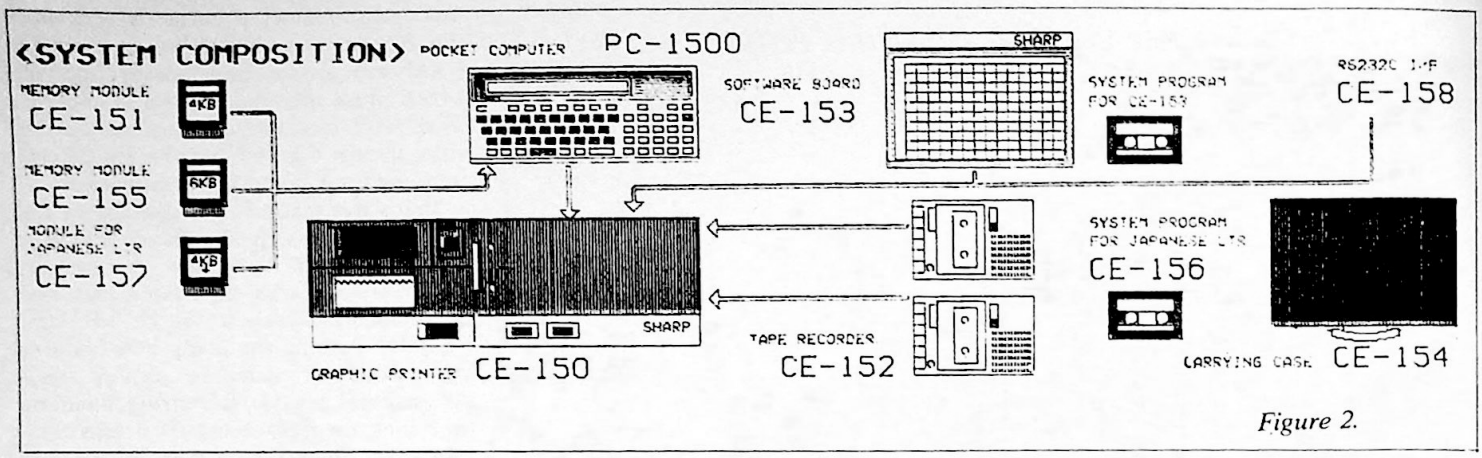


Figure 2.

function keys to produce these characters can save a tremendous amount of time in entering Basic programs.

The top row of alphabetic keys emit standard Basic keywords when their depression is preceded by hitting the DEF key. An overlay, which shows which keywords are associated with what key, is provided and is useful during program entry until the correspondence is memorized. The other alphabetic keys can be used with the DEF key to jump to a segment of a Basic program which has been appropriately labelled, as with the PC-1.

Perhaps the biggest attraction of the new system is the CE-150 Color Graphic Printer/Cassette Interface. At first glance, this unit looks like a bigger version of the dot-matrix printer/cassette interface available with the PC-1. At nearly two pounds and about 13" long and 2" high, the CE-150 is a substantial device, but it does a great deal of work in return. The connection to the 1500 is through a 60-pin bus connector at the edge of the computer; the CE-150 has an additional similar connector for connection of other devices to follow.

As a cassette interface, the CE-150 works very much like its predecessor, except that the transfer rate seems both faster and more reliable. Two cassette recorders can be remotely controlled, which can offer some operational convenience and might be useful in applications involving large amounts of data.

The hard copy section is actually a four-color X-Y plotter! Four tiny custom ball point pens fit into a turret which revolves to position one of the pens in the writing position. Sharp supplies two sets of pens, each containing black, blue, red, and green pens. The black pen is the default choice, but Basic can direct that any of the four be used at any time.

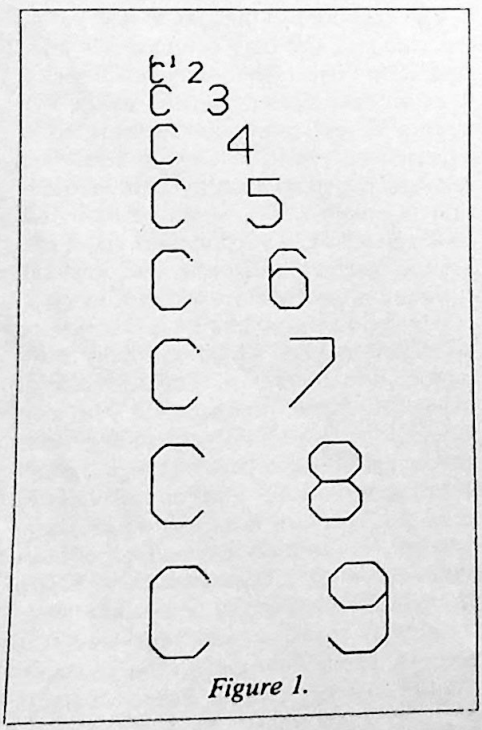


Figure 1.

Standard calculator paper is gripped tightly at both edges by rollers which have nearly invisible spikes which prevent any unwanted paper movement.

Text characters can be printed in nine different sizes ranging from a very tiny 36 characters per line to four very large characters a line (Figure 1). While perfectly legible, the smallest characters are a bit too small to read comfortably from any distance, and the CE-150 defaults to the next larger, 18 character per line size. Text can be rotated to print vertically for labeling graphs.

Pen movement is fully controllable in any of the four basic directions, and the minimum step width of only 0.2mm (1/64") allows very detailed, precise graphics. Figure 2 shows the incredible capabilities of the plotter/printer. It illustrates some equipment available in Japan which Sharp may not make available in this country.

A comprehensive set of graphic commands has been built into the new Basic interpreter to control the plotter, and these commands obviously allow an astute programmer to put the CE-150 through its paces in style. The Applications Manual supplied with the computer has several programs which use the plotter to good advantage, including business graphs and biorhythms (Figure 3).

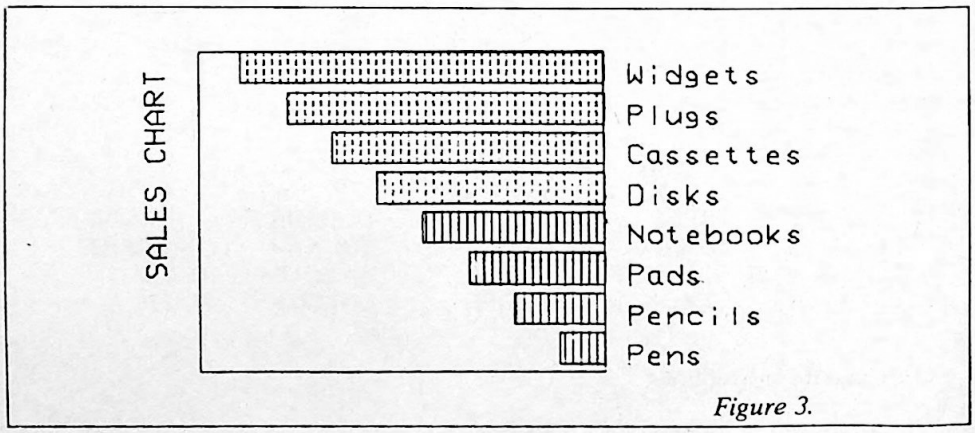


Figure 3.

User Evaluation

That the PC-1500 is a major advance over its ancestor is unquestionable. A series of benchmark tests revealed that the 1500 ran anywhere from 4 to nearly 20 times faster than the 1211/PC-1. It also ran significantly faster than the competing Casio hand-held computer.

On the other hand, the Panasonic/Quasar Link hand-held computer was much faster than the 1500 (the Panasonic

is an interesting unit which uses a 6502 processor and offers a wide variety of peripherals, including a modem, RS-232 interface, large memory capacity, video interface, ROM application packs and interesting software capabilities, but does not have cassette or any other storage other than in expensive memory modules, and has a terrible keyboard that is almost impossible to use without difficulty). The measured speed increases don't really convey the totally different "feel" of the 1500; the older model often felt sluggish and lethargic to someone used to a full size computer while the 1500 feels just fine.

The new Basic is excellent. The expanded vocabulary makes translation of programs written for larger computers using Microsoft Basic much easier. I have converted several rather long and complex programs to the 1500 with little or no difficulty. Some programs written for the PC-1 can be entered as published, but the variable handling is different enough that many older programs (especially those using programming "tricks") require some major reshuffling.

For original programming projects, the advanced string capabilities and logical operations make a big difference in ease of programming. In addition to all the new statements, several of the previously existing ones have been enhanced. BEEP offers much greater control over the tones emanating from the tiny built-in speaker, music can be produced readily, and the PAUSE duration can be controlled easily.

The plotter is an absolute knockout. The incredulous reactions received when plots are produced is almost worth the purchase price. As a pure hard copy printer, however, the slow speed of the plotter is a definite drawback. While printing speed obviously varies with character size, even at the smallest size, the plotter is much slower than the matrix printer on the PC-1. The listings produced are certainly compact, though.

The plotter is an absolute knockout.

The 8K expansion memory is the only way to go. It doesn't add any weight or bulk and greatly increases the capabilities of the unit. Long programs which were once out of the question are now perfectly feasible. Keep in mind that all Basic keywords are tokenized to one byte, so the 10K or so of RAM available with the 8K expansion actually can store the functional equivalent of much more.

It is a bit frustrating that no other peripherals are yet available for the 1500. I have seen a prototype of an RS-232 adapter which would allow interfacing either a standard modem or a large printer, but this device will not be available until much later this year (at a price of approximately $250).

Sharp currently has no plans to add any other external hardware devices in the near future. They evidently will be offering applications software in ROM, presumably to replace the RAM expansion module. This is fine, but I'm not sure I want to handle the sensitive CMOS RAM modules too frequently.

All in all, the Sharp PC-1500 and its associated products form a useful and exciting system. I still use my 1211/PC-1 and don't plan to scrap it. The recent drastic price reductions on the older unit may make it possible for some users to enter the world of hand-held computing who could not afford it previously, but for anyone who can pay the $300 ticket price, the PC-1500 system is the way to go.

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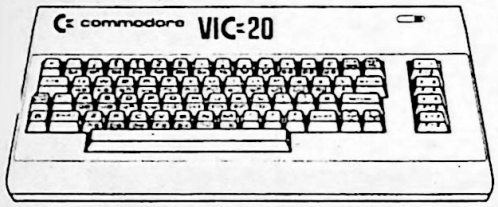

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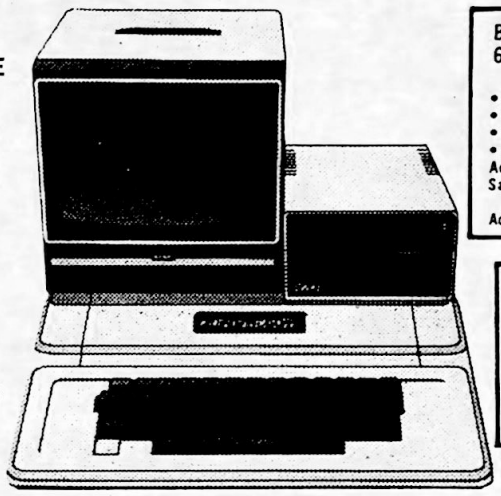

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★ ALS, 16K ADDRam	$ 59	60%
Saturn Systems, 32K	$ 169	25%
64K	$ 319	25%
128K	$ 459	25%
VC Expand 40 or 80	$ 75	25%
Axlon, 320K RAM Disk system	$1145	20%
80 COLUMN VIDEO CARDS:		
ALS, Smarterm	$ 229	34%
Videx, Videoterm	$ 249	28%
See more ALS and Videx under Miscellaneous		
Vista, Vision 80	$279	30%
M&R, Sup R term	$ 319	15%
MISCELLANEOUS:		
ALS, Smarterm 80 Col. Card Special	$ 229	34%
Z Card (Z-80) W/CPM Special	$ 199	27%
16K ADDRam Special	$ 59	60%
Synergizer Pack Special	$ 450	40%
★ Synergizer with free Sorcim Supercalc. (While they last)	$ 495	53%
Apple Computer,		
Silentype II Printer	$ 335	15%
Graphics Tablet	$ 675	15%
Joystick II	$ 39	22%
Game Paddle	$ 19	27%
Numeric Keypad	$ 119	21%
Axlon, 320K RAM Disk System	$1145	20%
CCS, Serial Interface 7710A	$ 139	22%
Other CCS Cards in stock	Call	Call
Dan Paymar, Lower Case Chips	$ 34	33%
Hayes, Micromodem II	$ 269	25%
Smartmodem	$ 229	20%
ISC, Videostick Paddle	$ 35	23%
Kensington, System Saver Fan	$ 75	20%
★ Keyboard Company,		
Joystick II	$ 39	22%
Game Paddle	$ 19	27%
Numeric Keypad	$ 119	21%
M&R, RF Modulator	$ 25	27%
SupRFan	$ 39	25%
★ Microsoft, Z80 Softcard	$ 269	33%
16K RAM Card	$ 149	33%
SoftcardPremiumPack	$ 579	25%
Mountain,		
CPS Multifunction Card	$ 209	13%
★ Clock/Calendar	$ 195	30%
Novation, Applecat Modem	$ 329	16%
Orange Micro, Grappler	$ 129	21%
★ Practical Peripherals, w/cable & Conn)		
MBS 8K Serial (Epson) New!	$ 129	20%
MBP 16K Para (Epson) New!	$ 129	20%
★ Microbuffer II 16K New!	$ 209	20%
Microbuffer II 32K New!	$ 229	24%
RH Electronics, Super Fan II	$ 59	21%
SSM, A10 Serial/Para Interface	$ 159	20%
TG Products: Game Paddles	$ 29	28%
Joystick	$ 45	25%
★ Videx, Videoterm 80 col.	$ 249	28%
Soft Video Switch	$ 25	29%
Enchancer II	$ 99	34%
Function Strip	$ 59	26%
Enchancer (Rev 6 or 7 +)	$ 99	25%
Full Videx Line	Call up to	35%

SOFTWARE on disk for Apple II/II+

BUSINESS

		SAVE
Apple Computer, Inc.		
50% Off on Apple III Software	Call	50%
The Controller (Accounting)	$499	20%
Apple Writer 1.1	$ 59	20%
Apple Pascal	$199	20%
Apple Fortran	$159	20%
DOS Tool Kit	$ 59	20%
DOS 3.3 Upgrade Kit	$ 59	20%
Apple Plot	$ 59	20%
DJ News & Quotes	$ 75	20%
DJ Portfolio Evaluator	$ 45	20%
How to!	$ 39	20%
Microcourier	$199	20%
Micro Telegram	$199	20%
Time Manager	$119	20%
Many Others	Call	Call
Applied Soft Tech., Versa Form	$289	26%
Artsci, Magic Window	$ 75	25%
Ashton-tate, dBase II (CP/M)	$495	30%
Beagle Bros., Utility City	$ 22	25%
Broderbund, Payroll	$269	30%
General Ledger	$349	30%
Continental, CPA #1 General Ledger	$189	25%
CPA #2 Accounts Rec.	$189	25%
CPA #3 Accounts Pay.	$189	25%
CPA #4 Payroll	$189	25%
CPA #5 Property Mgt	$189	25%
Denver, Financial Partner	$185	25%
dBase II for Apple II/II+ CP/M	$495	30%
Fox & Geller, Quickscreen for dBase II	$129	13%
Quickcode for dBase II	$259	13%
Hayden, Pie Writer (Specify brd.)	$125	25%
H&H Trading, Stock Tracker	$129	32%
Market Tracker	$199	33%
High Tech., Store Mgr.	$189	25%
★ Job Control Sys.	$469	40%
Info Master	$119	40%
Info. Unlim., Easywriter (PRO)	$139	25%
★ Innovative, Spellguard (CP/M)	$150	50%
Insoft, Accountant (CP/M)	$ 99	
For each GL, A/R, A/P or Payroll. Absolutely the best accounting software available for the Apple II/II+. Better than Peachtree. We use it and recommend it		
LJK, Letter Perfect	$112	25%
★ Micro Craft,		
(CP/M) Legal Billing & timekeeper	$250	65%
Prof. Billing & timekeeping	$250	65%
Micro Lab, Data Factory ver 5.0	$249	20%
Visifactory New!	$ 56	25%
Invoice Factory	$129	35%
Tax Manager	$ 95	38%
Micro Pro, (all CP/M)		SAVE
★ Word Star NewVersion	$199	47%
MailMerger	$ 69	45%
SpellStar	$119	40%
DataStar	$169	40%
CalcStar	$169	40%
SuperSort I or II	$119	40%
Muse, Super Text II	$113	25%
Super Text 40/80 New!	$129	25%
Form Letter New!	$ 75	25%
On-Line, Expediter II	$ 75	25%
ScreenWriter II	$ 95	27%
Osborne/C.P. Soft., (Disk and Book)		
★ Some Common Basic Programs. 75 Business, Statistics and Math programs for the Apple II	$ 49	50%
★ Practical Basic Programs. 40 more very valuable programs beyond "Some Com. Basic Prog"	$ 49	50%
Peachtree, GL, AR, AP or Inv. each	$189	36%
★ Magic Wand (Specify board)	$250	50%
Phoenix, Zoom Grafix	$ 29	28%
Sensible, Apple Speller	$ 55	27%
Silcon Valley, Word Handler	$150	40%
Solidus/Softech		
★ Stockfile	$250	60%
Stockseller	$425	40%
Software Publishing,		
PFS II or III NEW version!	$ 89	30%
PFS Report II or III	$ 69	30%
Sorcim, Super Calc (CP/M)	$219	25%
Southeastern,		
Data Capture 4.0, specify brd.	$ 69	25%
Source, The Source	$ 75	25%
Stoneware, DB Master	$179	22%
DB Utility I or II	$ 75	10%
VisiCorp/Personal Software,		
Visicalc 3.3	$189	25%
VisiDex Special!	$175	30%
VisiFile	$199	25%
Desktop Plan II or III Special!	$175	30%
Visiplot	$159	20%
VisiSchedule New!	$239	20%
VisiTrend and VisiPlot Special!	$210	30%
VisiTerm	$ 79	20%
Zork	$ 33	20%

UTILITY & DEVELOPMENT

		SAVE
Beagle, Utility City	$ 22	25%
DOS Boss	$ 18	25%
Central Point Software:		
Filer, DOS Utility	$ 18	25%
★ Copy II Plus (bit copier)	$ 35	10%
Will copy most copy protected software for your backup in 45 seconds or less! Highly recommended.		
Epson, Graphics Dump	$ 9	35%
Insoft,		
★ GraIFORTH by Paul Lutus New!	$ 59	22%
ALD System II by Paul Lutus	$ 59	22%
TransFORTH II by Paul Lutus	$ 99	20%
Electric Duet by Paul Lutus New!	$ 25	20%
Microsoft,		
A.L.D.S	$110	10%
BASIC Compiler	$299	25%
Cobol 80	$559	25%
Fortran 80	$149	25%
Olympic Decathlon	$ 24	24%
TASC Compiler	$159	22%
★ Omega, Locksmith (bit copier)	$ 75	25%
On-Line, Expediter II	$ 75	25%
Phoenix, Zoom Grafix	$ 29	28%
Source, the Source	$ 75	25%
Southwestern, ASCII Express	$ 59	25%
Sub-Logic, Flight Simulator	$ 28	20%
Tymac, Super Pix	$ 20	20%

HOME & EDUCATION

			SAVE
Autom. Slm., Crush Crumb Chomp		$ 30	25%
Broderbund,			
Apple Panic		$ 21	30%
Arcade Machine		$ 32	30%
Red Alert		$ 21	30%
Space Warrior		$ 18	30%
Star Blazer	New!	$ 24	30%
Many others		Call	Call
Budgeco, Raster Blaster		$ 22	27%
Calif. Pacific, Ultima		$ 30	25%
Cavalier, Bug Attack		$ 23	23%
Continental, Home Accountant		$ 56	25%
Home Money Minder		$ 26	25%
LA Land Monoply		$ 23	25%
DataMost, Snack Attack		$ 22	25%
Thief		$ 22	25%
Edu-Ware, Compumath		$ 29	25%
Hayden, Sargon II (Chess)		$ 29	22%
Infocom, Deadline	New!	$ 38	25%
Zork		$ 29	25%
Insoft, Electric Duet by Lutus	New!	$ 25	20%
GraFORTH by Lutus	New!	$ 59	25%
Lightning, Mastertype		$ 29	25%
Microsoft, Olympic Decathlon		$ 24	24%
Typing Tutor		$ 19	30%
Muse, Robot War		$ 29	25%
On-Line, Pegasus II		$ 22	25%
Mouskattack	New!	$ 26	25%
Time Zone	New!	$ 75	25%
Jawbreaker	New!	$ 23	25%
Ultima II	New!	$ 27	25%
Marauder	New!	$ 26	25%
Threshold		$ 30	25%
Cranston Manor		$ 26	25%
Mission Astroid		$ 15	25%
Mystery House		$ 19	25%
Softporn (X Rated)		$ 22	25%
Ulysses and Golden Fleece		$ 22	25%
Piccadilly, Falcon		$ 23	25%
Star Blaster		$ 23	25%
Sentient, Oo-TOPOS		$ 25	25%
Sirius, Sneakers		$ 22	25%
Gorgon		$ 29	25%
Twerps		$ 22	25%
Sir-Tec, Wizardry	New!	$ 39	22%
Strategic, Southern Command		$ 30	25%
OTHER BRANDS IN STOCK. CALL			

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CIRCLE 116 ON READER SERVICE CARD

The Panasonic RL-H1000 System

The RL-H1000, surrounded by (clockwise from top) I/O adapter, acoustic modem, RS-232C serial interface, programmable memory, micro printer, and TV adapter.

Pocket Power

Elliott S. Kanter

Ideally, when computers began to shrink and even approached pocket-size, we would have logically expected some breakthrough in program loading. That is to say, that if I was to have a pocket-sized computer, I would not expect to have to carry a tape recorder around with it in order to load a program or save data. Yet, initially, this was what the marketplace had to offer, along with some "smart-calculators" which found themselves being called and advertised as computers.

The Panasonic System, the RL-H1000, is a radical departure from either the "smart-calculator/computer" or the pocket-sized computer which requires a tape recorder in order to make any serious use of the system. And, system is what the RL-H1000 is.

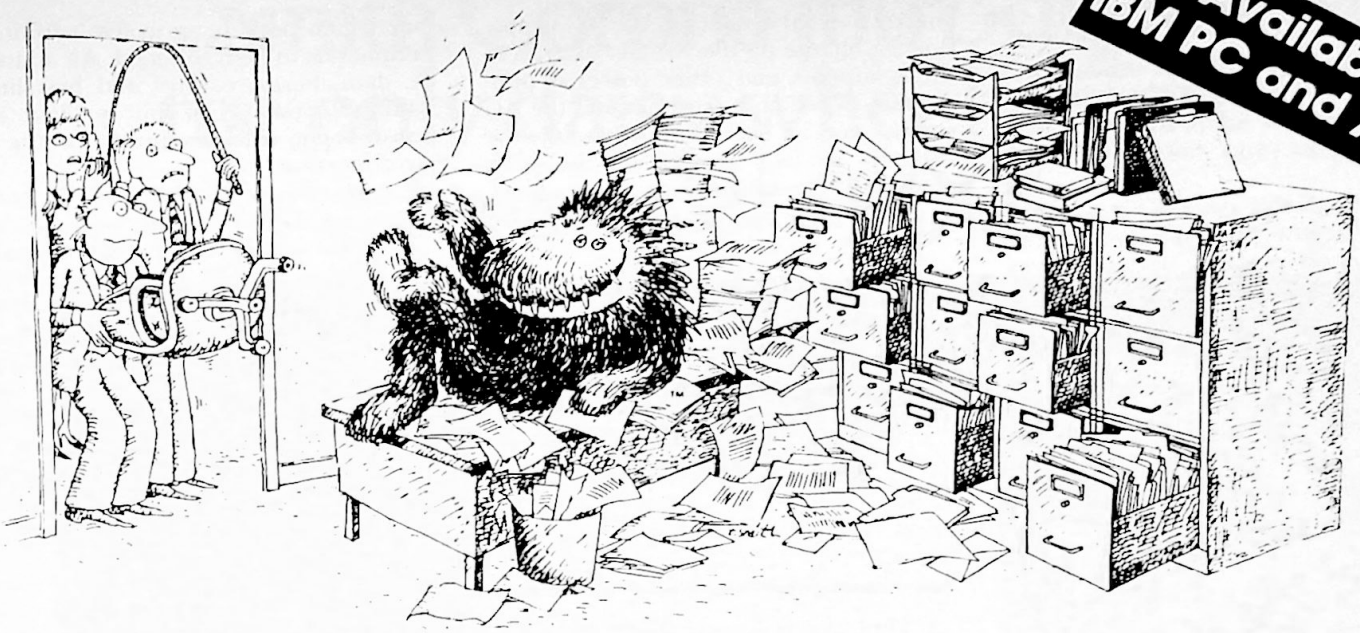
Unlike other computers which have been introduced and advertised as pocket-sized, the RL-H1000 is actually a go-anywhere, do literally anything system. Most dictionaries define system as a grouping of devices which could or should interconnect to some common goal, and the Panasonic System does just that with devices which are available now and include:

- Computer with either 2 or 4K RAM
- RS-232C interface
- Video/RF module
- Thermal printer
- Modem
- External RAM (4 or 8K) with battery backup

The system is quite different from some of the other pocket computers on the market today which are just now beginning to offer peripherals in limited selection. Panasonic elected to wait until the whole system was available before introducing the product, not as a simple computer, but rather as part and parcel of a complete system, ready to do the job,

Elliott S. Kanter, P.O. Box 257, St. Joseph, MI 49085-0257.

Available for IBM PC and Apple III



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regardless of where the job happened to be.

Simply put, once you get used to the small size of the complete system, you might just begin, as I did, to view it as a sort of portable and battery-operated Apple.

And, although it is available in a system configuration, you need not order items you do not need, or want; but rather, you can make your pocket computer just as simple or complex as you require, and maintain the ability to expand it at a time and date convenient to you.

In the beginning of this article, we related the sad state of affairs, in which a pocket computer was still forced to be connected to a tape recorder in order to do any meaningful work. Yet, as you will note from the pictures, there is no tape recorder in sight for the RL-H1000, because Panasonic elected to furnish the programs and features on what they call "Snapsules," which are user-installable ROMs with resident and menu derived programs such as:

- Clock/Secretarial/Calculator
- Personal Files/Records
- Telecomputing (either as smart or dumb terminal)
- Typewriter (actually a basic word processing system)
- MicroSoft Basic
- Snap Basic
- Pascal, Cobol and other languages

Again, it is *you* who decide what snapsules you want with your system; by the time you read this there should be a host of easy-to-use specially formatted programs to provide the RL-H1000 with a software library suitable for either the advanced or novice computer user.

Power Supply

The system is available with an AC power supply which is switch selectable for both US and foreign voltage sources. During normal operation, the AC supply floats a charge on the NiCad batteries in the computer and other powered peripherals. When both batteries and the AC supply are in use, that is to say the batteries are fully charged and the AC is plugged into a suitable source, you have, in effect, an uninterruptible power source.

Both color and black and white graphics are obtainable.

If the AC drops out, the internal batteries immediately take over, or in the case of a failure of an internal battery, the AC supply will carry the load with no loss of data. You must use the AC supply with the video module, but with that one exception, the system is content to operate for up to four hours on its internal power supply.

The computer is based on the 6502 chip, with a version of MicroSoft Basic said to be considerably faster than Applesoft.

The basic computer is available with either 2 or 4K RAM as RL-H1000 or RL-H1400 respectively. An internal ROM of 16K is standard with up to three user installable snapsules of 16K available.

Physically, the computer, regardless of the internal RAM is a mere 8-15/16" x 1-3/16" x 3-3/4" and weighs in at about a pound and a half.

A 44-pin edge connector allows the computer to interface with any *one* peripheral unit or to the Input/Output Interface which permits up to five additional peripherals to be interfaced. All addresses, data, buses, control and bias lines, bank selection lines, bus protect and power supply lines are present in the 44-pin connector.

Despite its small size, the keyboard offers 65 keys, in the conventional QWERTY format. They are redefinable with overlays, and interrupt driven with a two-key rollover. In addition there are user definable keys for frequently used terms, passwords or program commands.

A built-in five nickel-cadmium AA sized rechargeable battery pack provides for approximately four hours of continuous use, and the companion AC supply/charger extends the life of the batteries and allows the UPS protection described previously.

The display is a continuous, liquid crystal, with an 8 x 159 dot matrix, and a total of eight dots furnishing information about the system, battery condition or keyboard status as well. All characters, in upper and lower case are displayed with a speed control keyboard defined as well as a rotate, and stop function to "billboard" data as you require.

One complaint I have had about small computers, and calculators, has to do with the size of the keys and the space between them. This is because, like many other people, I suffer from that dread disease, FF, for which there is no known cure. If you, too suffer from it, you might want to consider alerting designers of equipment to the fact that a large portion of the adult population suffers from Fat Fingers.

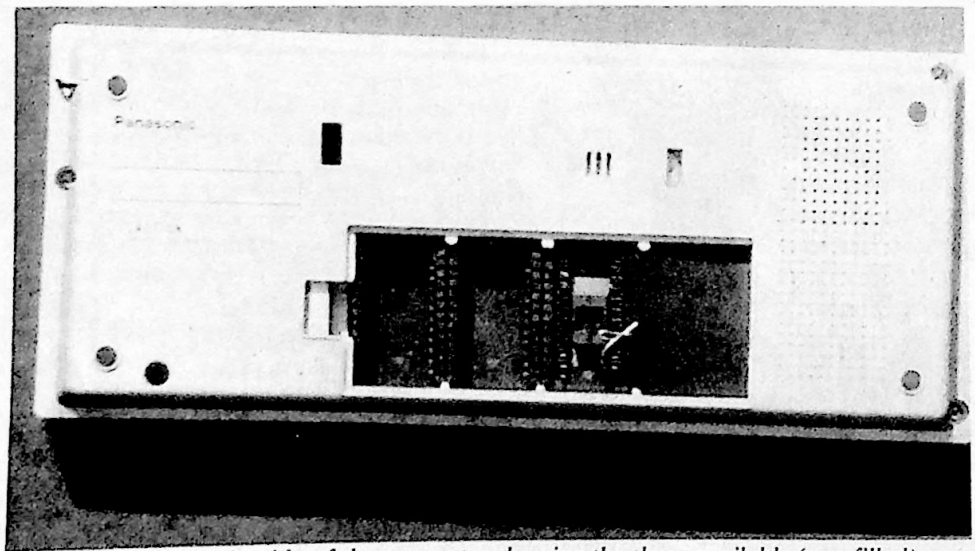
Apparently someone at Panasonic is a fellow sufferer, and despite the apparently compact keyboard arrangement, I found it relatively easy to use. All in all, I did find myself able to touch type data with few or no problems and actually be able to communicate via telecomputing on a duplex circuit.

The best way, at least from a review standpoint would be to take you on a tour of the remaining portions of the RL-H1000 system before adding some user comments and details. Thus we shall explore a typical system configuration.

Acoustic Modem Model RL-P4001

The acoustic modem provides two way communications from any standard telephone handset and offers asynchronous serial transmission in full or half duplex at speeds of either 110 or 300 BPS.

The transmission code and parity checks are user configured via a menu as is the election of full or half duplex. A single snapsule ROM for control application is found on the underside of the module, which receives its nominal 5 volts from the primary hand-held computer. This allows the computer and modem to



A view of the underside of the computer showing the three available (one-filled) snapsule sockets.

Smith-Corona introduces the only daisy wheel printer for under $900.*

You're putting together a desktop computer system for your office or home. And you want to add a letter quality printer so you can do word processing, too. But you don't want to spend a fortune.

Until now, you really had little choice but to settle for dot matrix printers. True, dot matrix doesn't produce letter-perfect printing, but daisy wheel printers just cost too much. That is, they did.

Now, Smith-Corona® offers a daisy wheel printer at such an incredibly low price, you can't afford *not* to get it. (The fact is, you won't find a daisy wheel printer *anywhere* at a price so low.)

The Smith-Corona TP-I™ printer operates with microprocessor controlled daisy wheel technology, and is available with either standard serial or parallel data interface. It is compatible with most microcomputers currently on the market. And, unlike many printers, it's made in America.

Best of all, the TP-I produces results identical to those of our very finest office typewriters—printing with real character. So it can be used to send out letters that have to look perfect. As well as financial statements, inventory reports, direct mail campaigns, manuscripts. Even a letter to your son in college! Anything at all you need printed.

The basic TP-I will handle letter or legal sized paper. An option that will be available soon will enable it to handle either fanfold or single sheet paper.

The TP-I is easy-to-use—just turn the power on, load the paper, and away it goes. There are drop-in ribbon cassettes and a choice of easy-to-change, snap-on daisy print wheels for a variety of fonts.

So stop thinking you can't afford a daisy wheel printer. Because, thanks to Smith-Corona, a printer with real character is no longer expensive. **Smith-Corona**

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*Manufacturer's suggested retail is under $900, but prices may vary.

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be used as a stand-alone data transmission and reception system, even from a public telephone booth.

TV Adapter Model RL-P2001

The TV/RF adapter module provides either a pure video out or a user selection of channel 3 or 4 when a dedicated monitor is not available.

A total of 512 characters—32 characters x 16 lines—is offered with a 5 x 7 dot matrix configuration. Upper and lower case letters and figures as well as symbols are displayed with a total character count of 116.

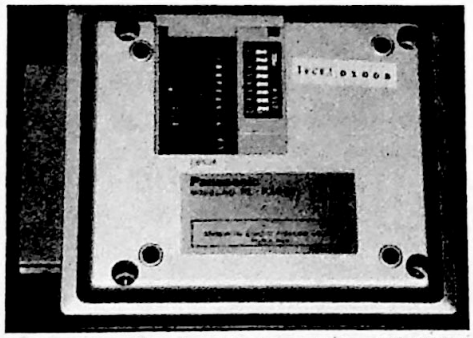
Both color and black and white graphics are obtainable depending on which application snapsule is used. Up to eight colors and an 8 x 12 dot character box are possible.

Signals, either TV or pure video, are provided to standard "F" connectors to allow simple and secure connections to either the TV or monitor. In the case of TV out, a switch box allows for rapid connection between the television set and the computer system with the ability to switch between computer presentations and actual TV programs by simply moving a switch.

Quick-connect "F" fittings on the supplied cables allow you to make connections without the need to screw down the connections manually. No other adapters are necessary unless your monitor will not accept the "F" connection. As mentioned earlier, the AC adapter/power supply must be used.

RS-232C Serial Interface Model RL-P3001

The serial interface module is used to interface the computer with any external device which uses an RS-232C interface. Transmission speed, user selected by DIP switch, ranges from 50 to 9600 BPS.



An underside detail view of the RS-232C module showing the DIP switch used to select the baud rate as well as the snapsule applications ROM.

A single applications snapsule socket, powered from the host computer, is located on the underside of the module. Input and output connections are made via a 25-pin Connector.

Micro Printer Model RL-P1003

The tiny thermal printer provides 15 characters per line with full alphanumeric and symbol printing capabilities. We did note that the 5 x 7 dot matrix left a bit to be desired in clarity, and the lower case letters lack true descenders, but this is also true of the basic computer display.

Using a cored, 38 mm (1 1/2") thermal roll, approximately 220 lines can be printed at a speed of 1.5 lines per second. The life of the thermal print head is given as 500,000 lines, or some 220 rolls of paper, before repair or replacement will be required.

Unlike other modules, the printer has its own internal rechargeable battery pack and should be able to operate independently for some four hours before requiring a recharge.

The system is designed for the user. Not just the expert but the novice as well.

Programmable Memory

Regardless of configuration, both modules (RL-P9001—4K bytes; and RL-P9002—8K bytes) provide the system with additional programmable RAM. Three AAA manganese batteries provide up to a full year of battery backup.

The RAM modules are powered from the primary unit and feature either two 2K CMOS RAM or four 2K bytes of CMOS RAM for additional memory expansion to the basic system configuration of either 2 or 4K bytes of RAM. Nominal 5 volts is supplied from the host computer and again, the module can be operated alone with just the computer.

I/O Adapter, Interface Model RL-P6001

The I/O adapter takes the system one step, or shall we say six steps, further. As mentioned previously, any one module can be connected to the host computer, but with the I/O adapter, a total of six peripheral devices (five via slots, one via I/O cable) can be added. Any device can be attached to any slot, with an automatic status and slot location reported when the I/O key is depressed.

Other Options

The AC Adapter, Model RD-9498 is useful and needed if you elect to use the video capabilities of the system. If you are a non-video user, the supply or adapter will function as the recharging system for the internal batteries as well as provide power for normal non-portable use.

Switch selection of either 120 or 220 volts allows operation from just about any power system you could find. At about two pounds, it is the heaviest accessory available for the system.

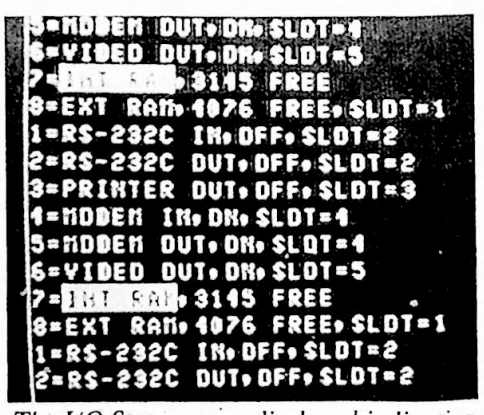
If you have configured a system, you obviously will not want to carry the components in pockets or bags, hence a fitted attache case is made available. It provides safe and secure (key-lockable) storage for the entire system as well as cables and manuals. Although the case seems to be sturdy, you are cautioned that it is a case and not a protective container.

Basically to this point we have explored some of the innovations, devices and the approach Panasonic took to produce the HLH System, but how does it work, or would you want to expend your hard earned dollars for a small in size, but relatively large capacity system.

The complete system as described carries a suggested retail price in excess of $2,000. When you compare its capabilities with other pocket computers available, there really is no comparison, but there is a price differential which could be important to some prospective users.

The system is designed for the user. Not just the expert but the novice as well. It is friendly, with most applications coming up in the form of menu presentations, which, by depressing a key, allow you to select, configure or even switch peripherals on and off from the keyboard.

The documentation, usually weak in new equipment, is very good. The user's manual is supplied in loose-leaf form which allows for updates, addenda, corrections, etc., to be added quickly. There is no need to reprint a manual to add data when the new pages can be inserted in a conventional business envelope and mailed to you for the cost of a single stamp.


5=MODEM OUT, DN, SLOT=1
6=VIDEO OUT, DN, SLOT=5
7=INT RAM, 3145 FREE
8=EXT RAM, 4076 FREE, SLOT=1
1=RS-232C IN, OFF, SLOT=2
2=RS-232C OUT, OFF, SLOT=2
3=PRINTER OUT, OFF, SLOT=3
4=MODEM IN, DN, SLOT=4
5=MODEM OUT, DN, SLOT=4
6=VIDEO OUT, DN, SLOT=5
7=INT RAM, 3145 FREE
8=EXT RAM, 4076 FREE, SLOT=1
1=RS-232C IN, OFF, SLOT=2
2=RS-232C OUT, OFF, SLOT=2

The I/O Status menu displayed indicating the position (slot #) and condition (on/off) of each of the system peripherals. This menu is keyboard selected with the I/O key.

All examples and instructions are clear and comprehensible, coupled with a friendly approach. It does not intimidate, but rather invites you to make use, or exploit to the fullest the capabilities of the computer.

The snapsules make a great deal of the friendliness possible. You don't load a program in the conventional sense, but rather, select a function and then are taken by the hand and led through its steps.

The secretarial function is a god-send to writers or people on the go. Appointments up to a year in advance can be entered with time, date, and information concerning the meeting.

When the time and date arrive, the computer beeps. Likewise the computer allows you to define or name files, and then invites you to enter information.

You can search a file with near disk speed by pressing the Search key and a few letters of the title or name you wish to locate. Your only limitation in establishing files or appointments or anything is the available memory (RAM).

Programming is nearly as easy as establishing a name and address file; all you do is title your program and finish the line with .BAS. This tells the computer that it is a program and not simply a file of data or records.

Conventional programming techniques are used and the system language supports statements such as: ?, Assignment, ATTACH, BYE, CALL, CLEAR, CONT., DATA, DEF, DIM, END, FOR, GET, GET#, GOSUB, GOTO, IF, INPUT, INPUT#, LET, LIST, LIST#, NEW, NEXT, ON POKE, PRINT, PRINT#, READ, REM, RESTORE, RETURN, STOP, TROFF and TRON.

Arithmetic and string functions, as well as numeric and string operators are likewise supported.

The internal Basic features a 9-digit floating decimal point, and access to the internal time and date clock as well as complete editing of the command line during program entry. As mentioned earlier, according to the manufacturer, the MicroSoft Basic for the RL-H system is faster than Applesoft Basic.

Considering that the Panasonic is the only true pocket-able computer system, I found myself playing the devil's advocate, trying to find some things not to like. I guess that the present limitation of available programs might be one of my temporary dislikes.

Some of my friends said it seemed too small, but I responded with "...it's supposed to be small."

Cost, considering everything, is not really a factor, it just seems to be higher than other similar systems, although the other systems don't offer the range of peripherals which do a lot to make up the $2,000 system cost.

In the final analysis, it is a true system with power and capabilities limited only by the user's imagination and level of sophistication. It is a user-friendly machine, which forgives errors, and makes you want to explore and exploit all of its capabilities.

Perhaps the best tribute I could give the system would be to say "No one would use it to play video games." It is a system for the serious user of computers, either in the office, on a plane, in a telephone booth or on the job, wherever that job might take him and the computer.

Recently, a listing of soon to be available "snapsules" was sent to RL-H owners with news of full-text editing, a form of VisiCalc, and a host of specialized programs designed for the business and scientific community.

For more information about the Panasonic Hand Held Computer System, write Panasonic Company, One Panasonic Way, Secaucus, NJ 07094, and remember to tell them you read about the system in *Creative Computing*. □

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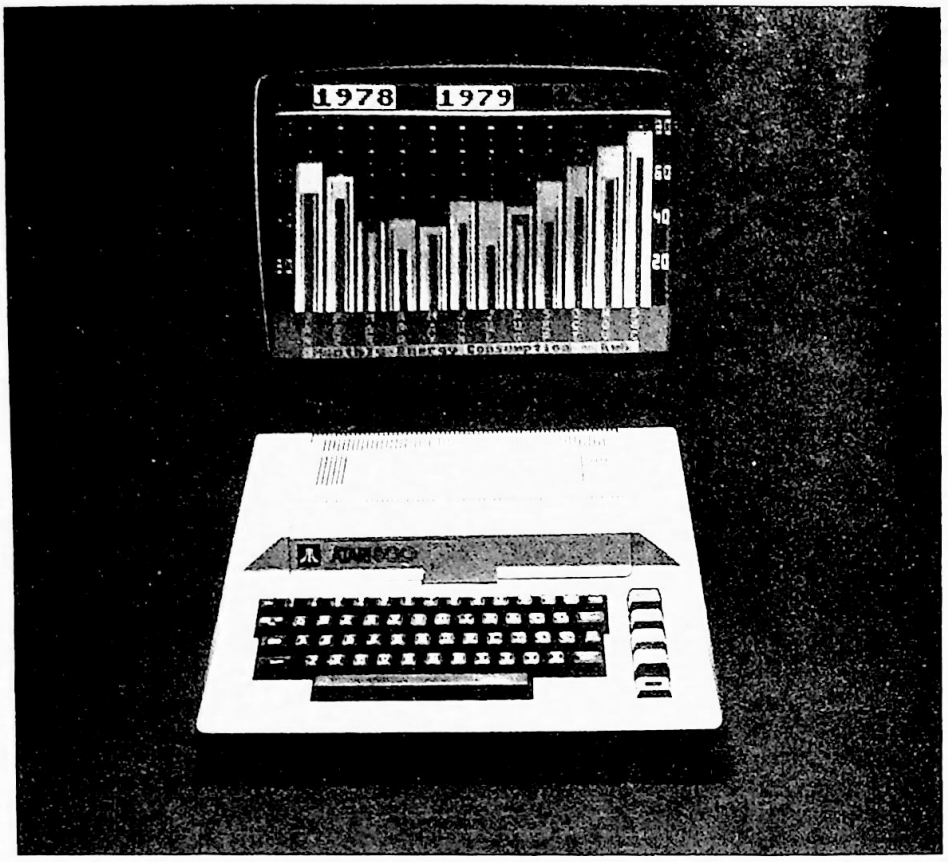
The Upstart Atari

John Anderson



June 4, 1981: The New York *Times* ran a relatively enlightened feature on the microcomputer and its future in the home. One of the "experts" cited in the feature stated the following: "there is almost no sense at all in buying a computer other than a PET, Radio Shack, or Apple." A bit further down the page, in a separate but allied article, the quote appeared *again*, this second time without the word "almost." The article referred to these companies as "the big three."

At the time, I was glad that the *Times* had discovered microcomputers, but was chagrined by what I saw as expert narrow-mindedness. Still, it came as no surprise to me. I had acquired quite a stiff upper lip by that time. You see, I am an Atari owner.

I remember when I first began shopping seriously for a micro, right about the time the first Ataris were shipped. I had a great deal of trouble getting anyone to talk about the machine. Sales staff seemed so resentful in one computer store, I wondered aloud why they even carried the thing. A salesperson exclaimed at me, through a sneer, that he did not expect it would be carried for long.

Even as recently as a year and a half ago, finding an article concerning the Atari in a computer magazine was a triumph. The machines remained a mystery, even to those who owned them. Documentation and software were scant. I was told by more than one learned microguru that I had made an expensive error. They predicted nothing but early death.

This was not to be. Despite the bad press and initial lack of documentation and software, the Atari was gradually discovered to be a superior machine: a "next-generation" micro, with ROM cartridge capability, a replaceable operating system, sophisticated color graphics capability, and four-channel sound. Despite initial snobbery and snubbery, buyers began to opt for a good machine at a good price. By Christmas 1981, the Atari was being sold faster than it could be manufactured.

A major part of what a microcomputer should handle really well is color graphics and sound.

How did the competition respond to the introduction of the Atari? With the introduction of Atari lookalikes. Studying these, I realized Atari must have done something right, to have nearly everybody else shouting "me too!" within a year or so.

The Atari has been called a game machine, and games have certainly sold their share of units. Ted Nelson took a look at *Star Raiders* on a video projection system and proclaimed that the Atari Personal Computer was the "most extraordinary (microcomputer) graphics box ever made." Yet in addition, the Atari could do anything the "big three" could do, and then some. Many prospective purchasers found in the Atari a double bonus: a chance to have a "serious" microcomputer, while owning the greatest game machine around.

And, it was friendly. It is easier to do things right on the Atari, and more important, hard to do things wrong. The jargon terms machines like this "user-friendly." Never before had a computer been introduced that was so easy to use. Until the Atari came along, you couldn't expect to take a micro out of its box, plug it in, and have it work.

In the operating system of the machine is a powerful, built-in screen editor, which makes the mechanics of programming much less formidable on the Atari than on other machines. I know that this, combined with the syntax-checking function of Atari Basic, allowed me to learn Basic programming at a much faster pace than would have been possible with any other microcomputer. These features simply allow the user to recover more gracefully from his own errors, thus vastly increasing the utility of the machine as a learning tool.

Then there is the cost. I literally "paid the price" to be the first on the block with an Atari 800. Now, because of the popularity of the machine, prices have dropped dramatically. A bit of careful shopping can result in a basic unit for under $700. For this price, you receive an 800 with

16K of RAM and Atari Basic. The computer has a built-in RF modulator and so can be hooked directly to your home TV. The basic unit isn't worth much without cassette or disk storage devices, which constitute an additional expense. However the Atari disk drive has also been heavily discounted, and can be found for under $450. A 48K disk-based system can be put together for under $100, and that is a good bargain at today's (and tomorrow's) prices.

Graphics and Sound

As for the capabilities of such a system, let me first insert here a warning to those who may be unfamiliar with the moiling and sweaty world of microchauvinism. I feel strongly, as do other Atari owners, that a major part of what a microcomputer should handle *really* well is color graphics and sound. I take this to be a self-evident, foregone and unimpeachable tenet, and will make no effort to argue for or defend myself upon that point. If you do not concur, then perhaps another machine is right for you; read on only at your own risk.

The 6502 microprocessor chip is the central processing unit of all current Atari machines, as it is for two of the "big three" machines. However in the Atari, the 6502 chip is backed up by three others, and therein lies a big difference.

One of these chips, called Antic, is itself a microprocessor. It is capable of an exotic potential known as "direct memory access," or DMA. Antic works in tandem with another chip, the GTIA or CTIA, to handle the video display, thus taking the burden of keeping the video screen "lit up" off the 6502. The CPU can go on to other important jobs.

I could attempt to outline each of the capabilities of these custom chips: 256 colors, up to 16 shades of a single color, 320 x 192 pixel resolution, player-missile graphics, modifiable display lists and character sets. However there really are only two ways to experience their power: watch an Atari graphics demo, or play a quality Atari game. The new GTIA chip, which replaces the CTIA, extends this power yet further.

Still another chip, called Pokey, generates, among other things, four channel sound. This sound can range from pure tone to many levels of distortion, allowing for music as well as sophisticated and complex sound effects generation. Sound is routed through the TV speaker, so volume control is as simple as the turn of a knob. Sound can be routed just as simply to your stereo. Nearly all music composition and game playing in my home takes place through headphones.

Software

The Atari is not without its problems. Much of the software written for it doesn't come close to taking full advantage of its capabilities. It seems as if many programmers are having trouble realizing how much power the Atari puts in their hands and how best to use it. Atari disk drives are slow. We still await 80-column capability, dual density drives, professional quality word processing and database management packages.

But relief is in sight. It was a trickle at first, but third party software began to pour in. The trickle became a gush, and the gush is becoming a torrent. Third party hardware followed soon after. The industry has reconsidered its initial underestimation of the machine.

A variety of talented minds are working with the Atari, investing it with a variety of new capabilities. The machine offers one of the most exciting forefronts in the microcomputer industry today.

Incidentally, the big three will shortly have to move over. I predict that by the end of this year Atari will be the number one microcomputer in its class, both in monthly sales and total units. □

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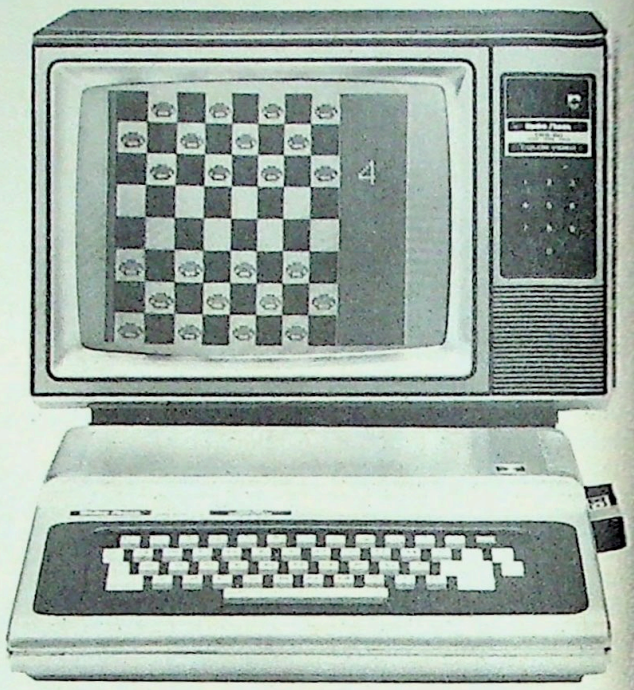
The Radio Shack TRS-80 Color Computer



Scott L. Norman

The Radio Shack TRS-80 Color Computer has a slight case of schizophrenia. Although it has been promoted as a games machine and household computer because of its compatibility with color television receivers, its 6809 microprocessor actually makes it a very powerful general purpose personal computer. The sleek silver machine has suffered from a relative lack of software support from its manufacturer, but the gap is now being filled by a spate of good programs from independent vendors.

When it was introduced in the autumn of 1980, the entry-level Color Computer was a model with 4K of RAM, programmed in a dialect called Color Basic. The current standard basic system has 16K of RAM at the old 4K price ($399). Extended Color Basic costs another $99.

Extended Color Basic is a very powerful graphics-oriented language, with single commands for drawing circles, lines, rectangles, and complex shapes defined by the programmer. It also supports sound effects and a full range of standard Basic functions and commands, making the Color Computer fully capable of scientific and commercial calculations. A pair of joystick ports and an RS-232 I/O port for connection to a modem or serial printer add to its versatility.

The Color Computer began life as a cassette-based system, but disk drives have recently become available from Radio Shack and at least one independent, Exatron. The Radio Shack disk operating system is completely transparent to the user. Basic simply acquires a few new commands when the disk controller cartridge is plugged into the computer. There is never any need to concern oneself with operating system commands, booting up, or any of the other esoterica common to other DOSes.

Scott L. Norman, 8 Doris Rd., Framingham, MA 01701.

The Color Computer has been underestimated by its manufacturer.

Software

The slot into which the disk controller plugs can also be used by "Program Packs," Radio Shack's preprogrammed ROM cartridges. Selling for $30-$40 each, these represent most of the software support offered by Radio Shack for the Color Computer to date. Most of the early packs were games, although a word processor and home finance and data management cartridges are now available. Naturally, disk drives cannot be used when a cartridge is plugged into the machine.

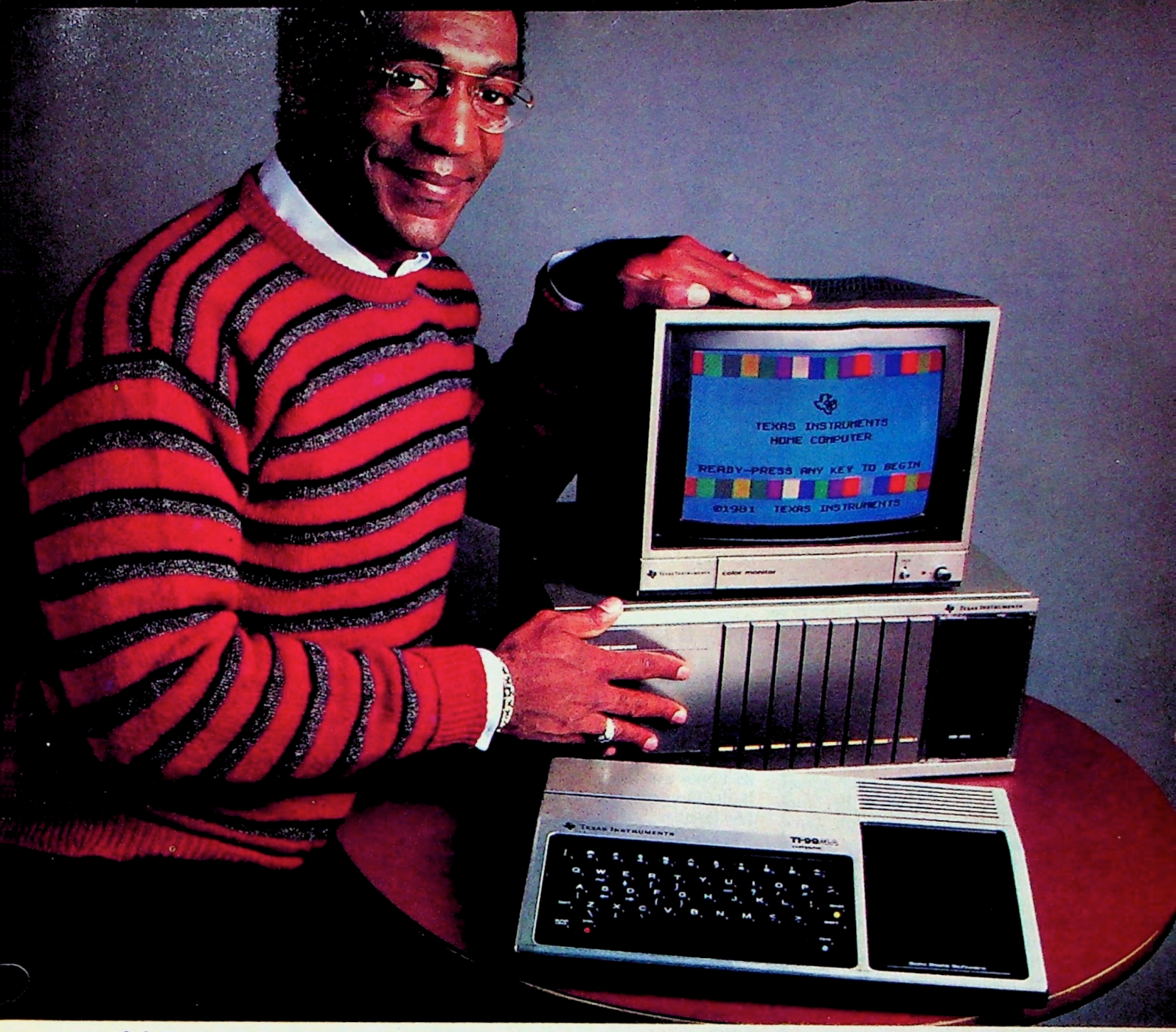
Independent vendors have stepped in to provide generally superior support. Several manufacturers now supply software in both cassette and disk formats, supporting my thesis that the Color Computer has been underestimated by its manufacturer.

The material in my own library includes word processors, games, assembly language programming aids such as editors and assemblers, graphics packages, a speech synthesizer, programs for converting the Color Computer into a terminal for communicating with mainframes, and even programming tools for the Pascal and Forth languages.

What can you actually do with the machine? Well, I do a great deal of writing: articles for personal computer magazines and drafts of reports for my job. I have, therefore, gotten a great deal of use out of my word processing programs. I have also used my intelligent terminal package to communicate with my employer's IBM mainframe. My job responsibilities include maintaining a large database for technical program planning, and I can now access it from my home, with the Color Computer serving as a perfectly competent ASCII terminal.

I must admit that I also maintain household databases (inventories) and financial accounts. Finally, my background in physics has left me with a modest analytical inclination, so I have been known to use my computer for the solution of physical problems. Here, as in most of my business and game programming, I try to make maximum use of the graphics capabilities of the Color Computer. I have even been known to make threatening noises about teaching a "for fun" physics course some day, exploiting these same capabilities.

How's that for a games machine? □



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What Can You Get For $299?

David D. Busch

It is no secret why William Shatner signed on for a tour of duty as spokesbeing for the Commodore VIC-20 microcomputer. At $299, the unit has more bells and whistles than Uhura's comm console, has three more voices than Spock's science computer, and is more fun than a barrel of tribbles.

As prices for real microcomputers drop to less than $100, and some video games retail for as much as $300, it becomes difficult to distinguish between game computers and computer games in the under $500 price range. To do so intelligently, we must look at the features available.

Those perusing any comparison chart will be tempted by the array of specifications on the VIC-20. They will brighten the eyes of sophisticated toy-seekers, as well as potential buyers with more serious computer aspirations.

Commodore has consistently advertised the VIC-20 at its $299 price, and I feel that it is important to show just what is and what is not included with that bare-bones machine.

For $299, you get a powerful 6502A-based microcomputer with a full-sized, full-stroke keyboard that compares favorably with those on machines costing much more. It includes four special function keys, and several control keys.

PET Basic, a version of the ubiquitous Microsoft Basic, is also included. This is no stripped-down entry level Tiny Basic or a "learner" language. It features the same complement of commands, including PEEK and POKE, found on much more costly CBM, Apple, and TRS-80 micros.

David Busch, 515 E. Highland Ave., Ravenna, OH 44266.

Extensive graphics characters can easily be redefined by the programmer into aliens, missiles, or foreign language character sets. Reverse characters, as well as upper and lower case letters, are all built in, and available at the touch of a few keys.

The full color display, which uses your color television or monitor, features eight character colors with 255 different combinations of screen and border colors.

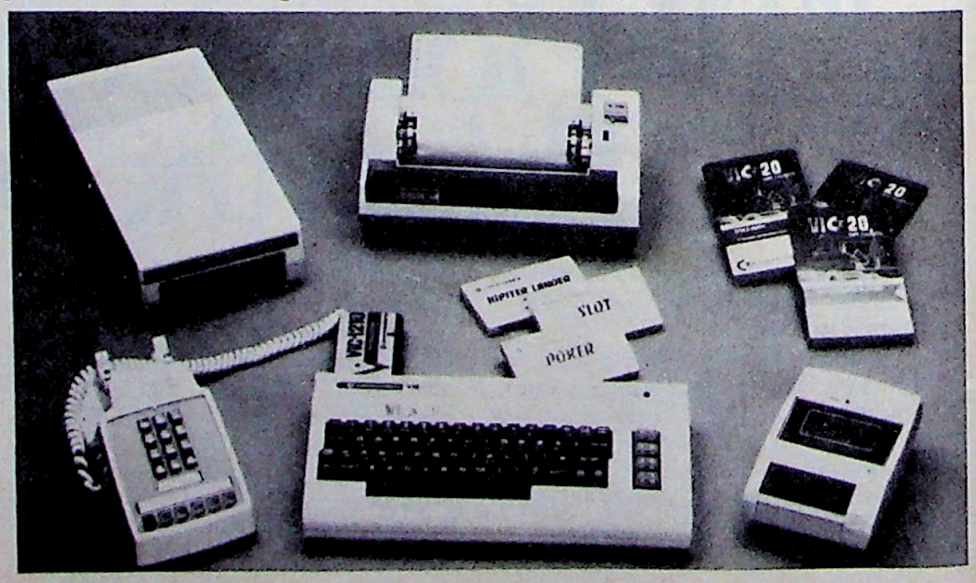
You also get three musical "voices," plus a fourth noise generator, which can be accessed through Basic programs, and played through the speaker of your television.

At $299, the VIC-20 also offers the purchaser one of the best games machines around. Despite the newness of the machine, there is already a selection of excellent games available on cassette tape and plug-in ROM cartridge. There are also a few dumb ones.

Video game players are accustomed to buying a cartridge, plugging it in, and playing. The bare-bones VIC-20 offers that convenience, but provides only one joystick port.

Miscellaneous other goodies, such as a built-in socket for an Atari joystick, paddles, or lightpen, are included. Other connectors allow the addition of extra memory, serial interfaces, disk drives, printers, and cassette storage. A realtime clock is standard.

There are also several things you do not get for your $299, some of which may be important to you. These add-ons—some hardly "options"—can boost the out-the-door price of the VIC-20 significantly.



Because few of us care to write a program longer than a few lines without having the ability to save it for reuse, it is necessary to add at least $75 for the Commodore Datasette cassette recorder.

This recorder/player is slaved to the VIC-20, deriving even power through a special connector. Attempting to interface some other, less expensive device to the VIC-20 would probably be poor economy. The Datasette has been modified to record a more reliably-read square wave (vs. sine wave) that allows use of even the cheapest audio cassettes for program storage.

Also lacking is an adequate Basic programming course. The VIC user's guide is a nice introduction to the machine, especially if the owner happens to be familiar with some form of Microsoft Basic. It teaches some fundamentals, and quite painlessly gets the neophyte involved in active programming rather quickly.

However, the guide does not deal with PET Basic in much depth, and has too few examples. It relies on graphics and sound to get the new user "hooked," but doesn't really do a thorough job.

So, you had better plan on buying a good teaching guide on Pet Basic, or the Commodore VIC programming course, and the VIC Programmer's Reference Guide. This will probably cost at least $20.

You get usable memory of only about 3.5K bytes with the $299 VIC-20. Gamesters and beginning programmers won't care about this, but serious programmers and operators with more than trivial applications will want to purchase 3K ($39.95) or 8K ($59.95) upgrades. For example, the VIC Typewriter program, a word processor, will allow input of more than 400 lines of text when run in a VIC-20 with 8K expansion memory. In an unexpanded version, only a scant 45 lines can be input.

VIC-20 Basic does not include color graphics or tone commands; No Line, Circle, Paint, Sound commands are available. These can all be accomplished from Basic using PRINT or POKE statements, but the Super Expander cartridge is a must for those who plan to use sound and graphics frequently. Add another $59.95 to your shopping list.

The $299 VIC-20 offers one of the narrowest screen widths available in personal computerdom—a scant 22 characters wide. This is possibly the only serious drawback to the machine because, unlike most of its other shortcomings, this one cannot be inexpensively fixed.

Following publication of another article I wrote on the VIC-20, I received several dozen phone calls and letters from readers. Every single one asked about upgrading the VIC-20 screen from 22 to a more usable 40, 64, or 80 columns. I told them all that such add-ons have been advertised. However, paying $200-$500 for a 40- or 80-column board and another $350 (minimum) for a color monitor moves the computer into another price class entirely—one that is just as highly feature-competitive as the under $500 class.

My advice, for the present, is to accept the display capabilities of the VIC for what they are: adequate for displaying color and graphics on all but the lowest quality color receivers found in the home. Actual character count is respectable; the VIC-20 allows 23 lines on the screen for a total of 506 characters. The Radio Shack Color Computer and Sinclair ZX81, on the other hand, while offering 32-character lines, can handle only 16 of them (512 characters.)

For many, the choice of the VIC-20 over some other computer may well boil down not to what you get, or don't get for $299, but what is available in the way of expansion options. Computer fans have a way of turning into computer nuts, and eventually computer maniacs. It is nice to be able to take a bare-bones machine and expand it to take care of needs and applications the owner never even thought of when the computer was purchased.

The VIC-20 is on secure ground here, although support from Commodore has been extremely slow. Accessories and software have arrived at computer stores in a trickle. Disk drives announced for late 1981 availability are only now on dealers' shelves. I wrote a dozen or so programs for the VIC-20 without benefit of line renumbering (try that sometime!) simply because I couldn't get a Programmer's Aid cartridge until May of 1982. I am still looking for the VIC 1010 expansion cage that will allow me to use add-on memory as well as other ROM cartridges, so that I can renumber programs longer than 3.5K.

Keep in mind, however, that the VIC-20 is a new machine, which was not widely marketed in the United States until the fall of 1981. In the meantime, Commodore has been concentrating much of its effort on its new high-end CBM systems, the Max, and the Commodore-64. While we VIC-20 owners may feel somewhat cheated, it is obvious that Commodore intends to support the machine. New products, such as the VICModem, have been innovative and low in cost.

Other manufacturers also appear to see the potential in the VIC-20. Look for a wealth of peripherals, games, and software as William Shatner's charm and charisma begin paying big dividends. □

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Sinclair ZX81

David Tebbutt

Right from the start, I had better explain that the ZX81 costs $80 in kit form and $100 ready-built and, as such, represents absolutely amazing value for money. Whatever shortcomings are highlighted in this Benchtest must be weighed against this fact.

Like the ZX80, its predecessor, the ZX81 will be available by mail-order and, by the time you read this, deliveries should be coming through. Clive Sinclair tells me that he plans to up production to 10,000 units per month starting in April and that he'll be producing 10,000 ZX80s to satisfy overseas demand, so, providing that 10,000 or fewer of you order the new machine per month, delivery should be swift.

Sinclair has been a bit cheeky in his advertisements. Under a column entitled 'New, improved features', he proceeds to mention three things that were included in the ZX80 when it was launched over a year ago!

For the benefit of those unfamiliar with the ZX80, it was the first ready-built computer to break the psychological $200 price barrier. It was well-made but looked slightly cheap in its lightweight plastic case and with its shiny keyplate. The 'keys' were printed on a plastic membrane with a metallised back; when each 'key' was pressed, the metallic back came in contact with PCB tracks, shorting them to complete the appropriate circuit. The system plugged into the domestic television to give an extremely clear display, and program storage could be made onto the home cassette recorder. The ZX80 came with 1k of user memory (RAM) and a 4k operating system/Basic language chip.

The main limitations of the ZX80 were the fact that it could not handle floating point numbers or cassette files. Also, when first launched, memory expansion came a bit expensive but this changed when the 16k plug-in RAM became available. The ZX80 certainly represented a great step forward and offered excellent value for money for people wanting to learn about computing.

So what in the ZX81 is new, compared with the ZX80? First, an extra 4k of ROM is provided, which allows 30-odd additional functions to be incorporated. This will also drive the printer (expected in the summer). I couldn't test this, but I have seen it working. It is an electrosensitive printer requiring aluminised paper, the surface of which is burnt off by an electrical discharge to reveal the black paper underneath. Don't study the photos too closely, because they show a model, not the real thing. The ZX81 costs an amazing $50 less than the ZX80, thanks to some neat design consolidation in a Ferranti chip custom-built to Sinclair's requirements. The total number of chips in the basic system is four, against the ZX80's 21. The ZX81 and its peripheral products are all cased in sturdy black ABS plastic. And very nice it looks, too.

Hardware

Although physically smaller than the ZX80, the new machine weighs in at 13oz, about 2oz heavier than its predecessor. The system needs a UHF television, a cassette recorder and a power supply to make it usable.

On my colour television the screen is a pleasant green and all characters are displayed in black. The machine offers no colour facilities and my guess is that you shouldn't hold your breath waiting for them. I suspect that a projection system based on three of Uncle Clive's miniature TV tubes might appear one day but, then again, I also suspect that he'd introduce another computer to take advantage of this. The display is 24 lines of 32 characters of which two lines are reserved for system messages and commands. Low resolution graphics are provided to give 64 by 44 plotting points. As with the ZX80, the display is very clear and rock-steady.

I'm pleased to see that the new power supply has its own flying lead for the attachment of a normal mains plug. (The ZX80 was awkwardly designed with an integral plug which often needed an additional socket or extension lead.) This power supply must give 600 mA at 9V but, since the ZX81 draws close to this, the standard power supplies actually give 700 mA and I would recommend that readers using their own supplies go for the higher rating, too.

Once again, the keyboard is formed by an underprinted plastic membrane which is everything-proof (water, chemicals, Coca-Cola, cigarette ash, monkeys, editors, etc). The keyboard layout is different from the ZX80's so, if you're upgrading, prepare to make a few mistakes at first. At the same time it is an improvement, since each keyword is frequently placed at or near its initial letter. (All you have to do now is learn the qwerty layout!)

Here are a few ideas for Uncle Clive: a plug-in battery pack, a plug-in single-line LCD display and a remote (infra-red or ultrasonic) facility so that you can sit in your armchair beaming the display information at an aerial adaptor on the television.

Compared with the ZX80, the ZX81 looks very smart indeed — one could almost say tasteful. It has a nice shape and texture and the keyboard is made of a non-reflective material, a definite improvement.

The plug-in 16k RAM pack fits to the edge of the PCB where it protrudes from the rear of the casing. The cursor takes a while to appear at switch-on, because the system is checking to see how much memory is present in order to set certain system variables. If you're a machine code freak you can reset the RAMTOP variables in order to give you somewhere safe to tuck your precious program.

Five screws hold the ZX81 together; three of them are hidden under the pads on which the machine stands (footpads? — surely not). You know what I mean —

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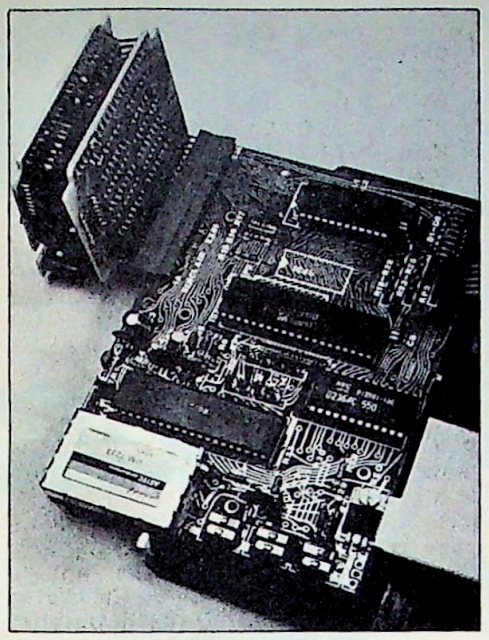

those non-skid things. There's a substantial heat sink for the regulator under the rear of the keyboard — it's a good place to warm your hands on a chilly morning. The PCB is held into the casing by two screws. The keyboard is separate from the main PCB and is connected to it by a couple of flat printed cables. The main PCB is well designed and neatly made. Assembly of the ZX81 is done very professionally by the Timex Corporation in Scotland (the same people that are making Sinclair's latest miniature television).

The basic ZX81 contains four chips — ROM, 3.5 MHz Z80A CPU, 1k memory and the Ferranti custom-made chip — plus a limited assortment of bits and pieces. It's very, very simple — I think even I could build it. A few spare positions on the board give the manufacturer a certain amount of flexibility to tweak the machine to the requirements of different television systems and to be prepared in case a memory chip famine occurs. The Ferranti chip handles all the I/O and control signals between the various elements of the machine. Nosing around inside, I notice that it has a very cosmopolitan flavour, with memory from Malaysia, the CPU and ROM from Japan, a UHF modulator from the Philippines, a regulator from El Salvador and the custom chip from Britain. The edge connector is not gold-plated (what do you expect for $100?); it's just the PCB printing taken out to the edge. The 16k RAM pack contains two boards connected at the edge. One board contains eight 4116s which are driven by the other board's assortment of seven chips which handle the memory addressing and refreshing.

Software

The ZX81 syntax-checking is excellent because, unlike the ZX80's, instead of operating on each character as it's entered, the system waits until NEWLINE is hit. Finding your way around the keyboard at first is a real hoot — some of the keys have five functions. As before, the single stroke keyboard entry is a joy to use and the automatic spacing inserted by the system makes program listings clearly legible. For example, if you tried to enter 10FORN=1TO10, it would appear as 10 FOR N=1 TO 10. Pretty neat, huh?

Editing is very simple. You position the cursor on the line to be modified, hit the EDIT key and then make your corrections. Additional characters and functions are automatically inserted at the cursor position within the line while RUBOUT deletes the character or function to the cursor's left. A touch on the NEWLINE key confirms the changes.

The machine can be used as a calculator but shouldn't be bought for that purpose since the precision is less than one would expect of such a device. It is, however, far better than the integer-only ZX80, offering $+/-10^{+/-38}$. If numbers get out of hand it presents results in standard scientific notation. For those who can't readily visualise this level of accuracy, it means numbers up to 4,294,967,295 can be represented with complete accuracy. That's $2^{32}-1$. The smallest positive number is about 4×10^{-39}. Five bytes are needed to store a number, which goes a long way to explaining why the Benchmark timings are slower than with the ZX80, which only required two.

An enormous number of functions have been crammed onto this rather small keyboard. This has been achieved by using two special keys: graphics, which allows the user to key all the graphic characters as well as the normal characters as white on black; and function, which allows the user access to (surprise, surprise!) special functions. A normal mode of operation also exists. In addition to all this, the keyboard has a bog-standard shift key, thus increasing the range of options for each key still further.

The character set is a one-off — it's not ASCII or anything I recognise. I think we'd be safe if we called it Clive code. The TV display isn't exactly memory-mapped — it tends to move around and change its size depending on what's going on. It is, however, possible to find the start of the screen area and then to access the screen by PEEKing and POKEing the screen locations in the buffer.

Basic

All but one of the ZX80's Basic functions, plus a substantial number of additions, have been incorporated into the 8k ROM which drives the ZX81. The following commands and statements are provided over and above the old ZX80 repertoire: ASN, ACS, ATN, COS, EXP, INKEY$, PI, SGN, SIN, SQR, INT, LEN, LN, TAN, VAL, <=, >=, <>, COPY, DIMA$, FAST, FOR...

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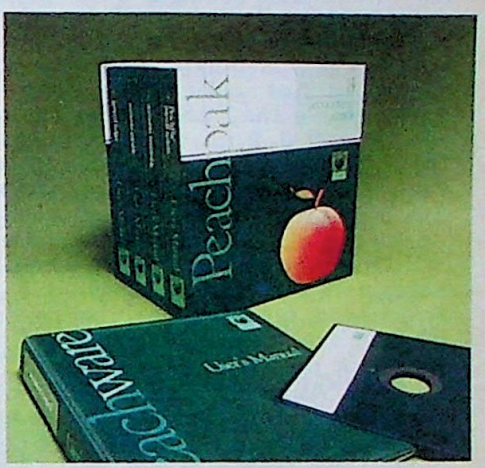

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TO. . . STEP, LLIST, LLIST n, LPRINT, PAUSE, PLOT, PRINT AT, PRINT TAB, SCROLL, SLOW, UNPLOT. The missing function is TL$, which was used to return a string minus its first character. This ROM plus an appropriate keypad overlay is available to existing ZX80 users who wish to upgrade their machine. They should note, however, that even with the new ROM they will continue to get the screen flicker which, I'm sure, they've grown to know and love by now.

The machine can be operated in two modes — SLOW (sometimes called 'compute and display'), and FAST. FAST mode offers the world famous screen flicker every time you hit a key, while SLOW mode keeps the screen refreshed at all times, resulting in a nicer display, moving graphics and a lot of irritating delays: see the Benchmarks for comparisons. If you need to see the screen continuously then SLOW mode is a boon. If you don't, say if you were doing lots of calculations, then it's better to use the FAST mode. The two can be called from within a program, thus offering the best of both worlds. The SCROLL feature removes the top line from the screen and moves each line up, leaving a blank bottom line. Without SCROLL, the display freezes when the bottom line is reached. A PAUSE instruction is provided which suspends a program's operation for a user-defined period or until a key is depressed. The screen is visible when in PAUSE mode, regardless of whether the program is running FAST or SLOW. In SLOW mode the screen flickers slightly when the PAUSE takes effect but in FAST mode it has to come on altogether. This means that you'll have to be careful not to have your PAUSEs too close together, unless you actually enjoy watching the screen going absolutely bananas. The INKEY$ function is welcome since it can be tested to see if a key is being depressed and, if so, which key it is. This feature is great for fast-moving games since you need only hit the key you're interested in — there's no need to hit NEWLINE.

There are no DATA or READ instructions but this can be circumvented by saving a program with all its associated variables and then using a GOTO to kick the program off when it's reloaded. (RUN automatically clears any variables.) Pressing CONT, not surprisingly, allows you to continue the program. PLOT and UNPLOT functions (0,0 is in the bottom left-hand corner) are provided, giving a graphics capability of 44 by 64 points. Each point, or pixel (picture element), is a quarter the size of a normal character. Hardly high resolution but better than a poke in the eye with a sharp stick!

The cassette needs either 35mm sockets or an appropriate adaptor. SAVE is offered but no VERIFY, so saving a long program can be a bit worrying. I suggest you first save a few short programs, just to make sure the controls are set properly. When loading a program, the pattern on the screen shows you when data is being recognised. The theory of cassette adjustment is that you play a data tape, gradually turning the volume up until the pattern appears. Then you turn it up a little more and it should be ready for use.

The printer, when it arrives, will allow you to LPRINT and LLIST data and programs respectively. Even better, it will allow you to dump the screen contents to the printer using the COPY command either within the program or as an immediate instruction. Such a screen copy takes about 12 seconds to produce.

The only function to disappear is the TL$ command mentioned earlier. The same thing can be accomplished using the LEN and TO instructions. All trigonometric stuff is in radians and PI is provided to help you unravel the results. SGN = signum which can possess one of three values: −1, 0 and +1. At one stage the new ROM (for the ZX80 and, subsequently, for the ZX81) was expected to offer DRAW, UNDRAW, DATA, READ and RESTORE features. Instead I think the idea of adding printing facilities became more important. After all, these features can be realised using the existing range of commands.

A character string of any length may be used as a numeric variable name, providing it starts with a letter. String variable names are restricted to A$ to Z$. String and numeric arrays may be any number of dimensions — the limit is dictated by the amount of free memory available. String arrays are character arrays really, with the last entry in a DIM statement being the number of characters per array element. With a full 16k RAM and a small program (it fitted on the screen) I set up a string array 100 x 6 x 25 characters long. I used this since each element would be about the size of a name and address record, allowing extra information like telephone number and birthday, for example. Substrings are handled using the TO function. LET A$=B$ (3 TO 5) would make A$ a three character string comprising the third to fifth characters of string B$. This open up possibilities for giant strings and the use of string slicing to extract variable length fields.

Documentation

A programming book is provided with the system: *ZX81 Basic Programming* by Steven Vickers. The cover is a very odd photo (montage?) of what appears to be a couple of model delta-wing jets on top of a solitary skyscraper at night. Two red windows peer at you from the upper floors. It must be full of deep meaning which totally escapes me. Sinclair Research specially commissioned it. Can any psychologist readers tell us what it's all about, please?

Technical Specification

CPU:	NEC Z80A, 3.5 MHz
Memory:	1k RAM expandable to 16k
Keyboard:	Plastic membrane under-surface printed
Screen:	Domestic UHF television
Cassette:	Domestic audio recorder
Firmware:	8k ROM containing Basic and operating system

Binary Operations

\+ — * / ** = > < <= >= <>

Statements (all except INPUT may be used as commands)

CLEAR	CLS	CONT	COPY	DIM	FAST	FOR..TO..(STEP)	GOSUB
GOTO	IF..THEN		INPUT	LET	LIST	LLIST	LOAD	LPRINT
NEW	NEXT		PAUSE	PLOT	POKE	PRINT	(TAB)	(AT)
RAND	REM	RETURN		RUN	SAVE	SCROLL		SLOW
STOP	UNPLOT							

Functions

ABS	ACS	AND	ASN	ATN	CHR$	CODE	COS	EXP	INKEY$
INT	LEN	LN	NOT	OR	PEEK	PI	RND	SGN	SIN
SQR	STR$	TAN	USR	VAL					

Benchmark Timings (in seconds)

	Slow	Fast	ZX80
BM1	17.7	4.5	1.5
BM2	27.2	6.9	4.7
BM3	65.3	16.4	9.2
BM4	63.0	15.8	9.0
BM5	74.2	18.6	12.7
BM6	199.3	49.7	25.9
BM7	275.6	68.5	39.2
BM8	91.6	22.9	couldn't be done

The book is written for the novice, and it does a pretty reasonable job. It is infinitely better than the book given out with the ZX80. What a pity, then, that just as the reader is about to key something in for the first time, he encounters the most off-putting (and unnecessary) paragraph in the whole book: 'A message like this, telling the computer to do something straight away, is a command; this particular one is a PRINT command, but also a PRINT statement. Calling it a PRINT statement just specifies its form without referring to how the computer is going to use it. Thus every command takes the form of a statement, but so do some other things — program lines do, as we shall see in Chapter 8.'

The style of the book isn't really to my taste although Steven reveals a lot about himself with his talk of dead tax collectors and expressions like 'Lor', love a duck'. *Eye* fans will be delighted with his reference to *Talbot?* on page 38 (I find the question-mark rather becoming, don't you?). Oddly, error codes are referred to as report codes. Perhaps the idea of associating errors with the machine was just too abhorrent, even if they do happen and even if they are usually the user's fault. Ho hum — more psychologist fodder. There are the usual typographical errors which didn't get cleared up but I couldn't find too many. The only other thing in the manual which actually troubled me was the reference to pounds, shillings and pence in one programming example. My kids (aged ten, eight and six months) didn't know what it was all about and, let's face it, a lot of these machines are going to be bought by, and for, kids.

Potential use

Who would use this machine? Kids will love it (so will Dads) and, at this price, I can't think of a better way of introducing them to the subject. Most courses on computers and especially on Basic programming cost more than the ZX81. In my view you can buy a ZX81, have a lot of fun, learn a bit about computers and Basic programming and decide whether you like it or not. If you don't like it or if you decide to move on to bigger and better things, you can always sell the machine (or give it to ComputerTown). The 16k RAM pack is a must for anyone doing anything remotely serious. The printer, when it arrives, will give you the chance to keep a record of all that interesting stuff you've got locked in the machine. The floating point arithmetic certainly makes the ZX81 a far more useful machine than the ZX80 and I suspect that many people will give it serious consideration as a result. You must bear in mind the sort of limitations imposed by the ZX81's inability to handle files. You can save a program with all its variables on tape, which gives you 16k for both programs and data. In my earlier example, I managed to get 100 records of 150 characters each into memory with a short program of 20 lines or so. There's no reason why you shouldn't record the program again with another 100 records, which would overcome this particular limitation. The only problem you'd be left with, then, is the fact that other programs cannot access the same data. I think that if you're really worrying about this sort of thing then maybe you require a more substantial system.

Expansion possibilities for the ZX81 are limited at the moment to the printer and the 16k RAM pack. I asked Clive Sinclair if there was any chance of disks being developed and he gave the same enigmatic answer he gave a year ago when I asked the same question about the ZX80: 'We're working on it.' Draw your own conclusions.

Conclusions

He's done it again. Uncle Clive has come up with a lovely product which will have enormous appeal to people wanting to find out more about computers, but without it costing them an arm and a leg. The idea of producing a superior machine to the ZX80 and selling it for a lower price is absolutely wonderful. I'm full of admiration for the man. Most people would have upped the spec and held the price ('It really hurts me to do this') or even increased it slightly. The product is clearly aimed at the home market and I'm sure that it will do extremely well there, far better in fact than the ZX80. And *that's* rapidly becoming the biggest selling micro in the world!

People who are wondering about its relevance to business or serious work at home ought to sit down and do a few calculations on just how much information they need to hold and how they wish to access it. You could hold 100 or so names and addresses or keep track of around 600 financial transactions in one load of the 16k memory. These figures allow for a fairly simple entry and enquiry program in each case. By abbreviating information you can clearly cram more in. By splitting your information across several tapes you can build a substantial file of information but each tape would have to be managed by a separate version of the program.

If you know nothing about computers and you want to enjoy finding out about them, then this machine offers a value for money way of doing just that. Children will love the ZX81, there can be no question about that, and I suspect that more than a few people who are already familiar with computers will buy one, just to have a bit of fun.

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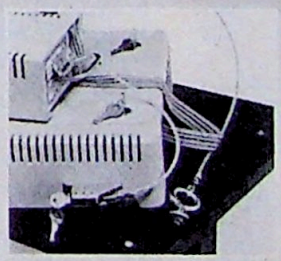

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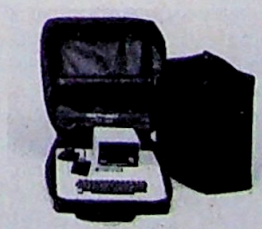

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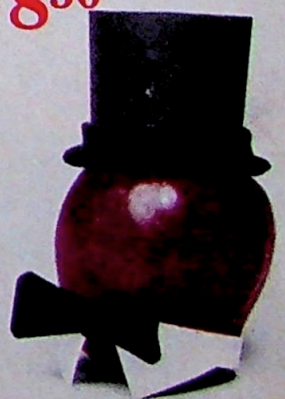

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Uncle Clive Does It Again

David Tebbutt

Well, he's done it again, hasn't he? Uncle Clive has gone and shown the world how to produce a decent colour personal computer at the sort of price only he can conceive. Two versions of the Spectrum are available — 16k and 48k at $220 and $310 respectively, *including* VAT. If you want to upgrade your 16k machine to 48k later on, it will cost you $100. At the moment, the machines are available only by mail order. The Spectrum (ZX Spectrum to be precise) offers colour, high resolution graphics and sound and, at the price, it has just got to be the best value for money around.

Like most computers at this level, the Spectrum plugs into the domestic television and uses a normal cassette recorder. The ZX printer can be attached and, with a little modification, ZX81 programs will run happily on the Spectrum. An $88 miniature disk drive (the ZX Microdrive), communications facilities and an RS232 interface will be announced later on.

Hardware

The Spectrum measures just 233x144x 30mm and weighs in at 520 grams excluding the separate power supply and cables. It looks extremely elegant and, unlike its predecessors, it has keys that actually press down.

You'll not be surprised to learn that there are hardly any components inside the machine: 14 chips, a UHF modulator, a piezo-electric 'speaker' and an assortment of capacitors, resistors, diodes, crystals and a coil make up the complement. I swear that some of my crystal sets had more in them. All this is mounted on a single board and, looking underneath this production prototype, I notice that there's not a single patch. The only odd thing about it is that there's a big blob of green plasticine stuck around the coil. The coil on the review machine does whistle a bit but I understand that production machines come with suitably lacquered coils to eliminate this problem.

A hefty edge connector at the back brings out just about every signal you could wish to have. This is used for printers, communications and disk drive connections. Inside there are two spare sockets which accommodate each end of the 32k memory expansion board. This is a great improvement on the ZX81 memory expansion which tended to drop off the back of the machine at the least provocation. Talking of sockets (well I was, just now), every chip except the ULA is socketed. The reason the ULA isn't is because it gets darned hot — putting it on the PCB allows the heat to dissipate better.

The keyboard comprises a one-piece grey rubber moulding mounted over a pressure-sensitive membrane. The keys poke up through holes in a black metal plate and I must confess the feel is more that of a calculator than a typewriter. Most keytops have three symbols on them and, in addition, most of them have another two associated inscriptions printed on the metal surround. If you're anything like me you'll find yourself reading the whole keyboard each time you want to find a function. You do get used to it after a while: in my case it took a couple of days. I found that red symbols on grey keytops are quite difficult to read and, thinking my eyesight might be going, I showed the machine to a number of friends, all of whom had the same difficulty. I showed it to my 11-year-old and he thought it was just fine, though.

A power supply is included in the price, so there's not a lot of point risking one of your own and blowing the Spectrum up. The two cassette leads terminate in 3.5mm jack plugs so be sure that they work with your recorder before you embark on any major programs. It took me four or five tries before I found the right volume setting on my tape recorder. Once this was found, though, program loading presented no problems.

I tried the Spectrum on three televisions and the results matched the quality of the sets used. The display comprises 24 lines of 32 characters with the bottom two lines reserved for messages and entries. The display can also be regarded as 176 x 256 resolution for graphics work. High resolution graphics work is best done in two colours as you will see in the Firmware section of this review. The screen, border and individual characters can each take on one of eight colours and, in addition to this, characters can be bright or flashing. Other screen attributes like inverse and overprinting relate to the whole screen. More on these later.

The single channel BEEP facility is about what you'd expect from a piezo-electric speaker. It does sound slightly better amplified from the cassette port but it's still pretty awful. A couple of octaves around middle C aren't bad; but the other eight are best used for sound effects. At the high end they warble and at the low end they grate — BEEP is a refreshingly honest description.

Really, there's not a lot more to say

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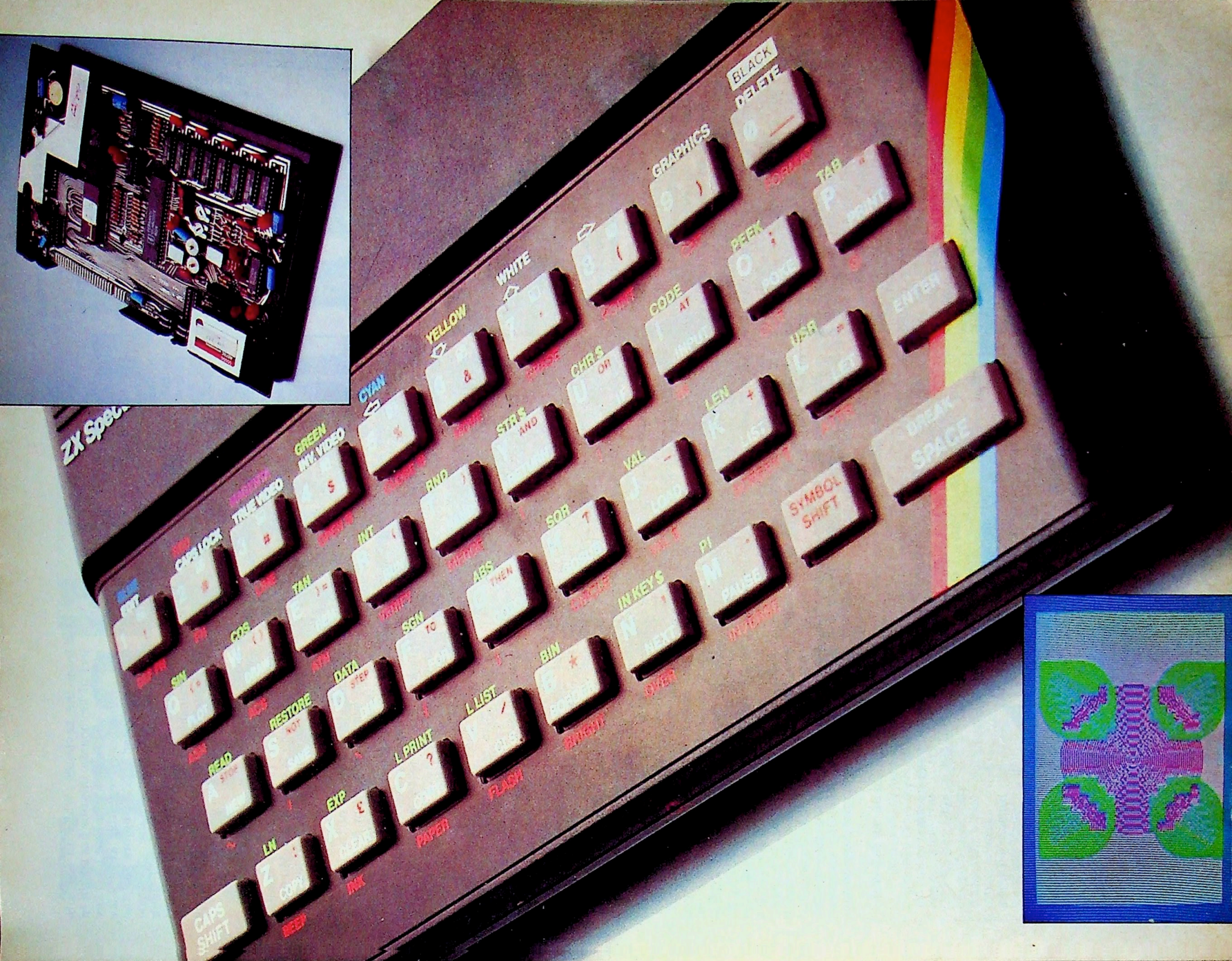
BLACK
DELETE
GRAPHICS
WHITE
YELLOW
CYAN
GREEN
INK VIDEO
TRUE VIDEO
CAPS LOCK
TAB
PEEK
CODE
CHR$
STR$
RND
INT
TAN
COS
SIN
ABS
SQR
VAL
LEN
USR
ENTER
PI
IN KEY$
BIN
SGN
DATA
RESTORE
READ
L PRINT
L LIST
EXP
LN
SYMBOL SHIFT
BREAK SPACE
CAPS SHIFT

What About the '81?

It was no secret that 'Uncle' Clive was going to launch a knockout micro — he's put a bomb under the industry twice already, producing machines which brought computing power within everybody's reach at prices which drastically undercut the competition.

A slightly upmarket (by Sinclair standards) machine offering colour and sound and reasonable graphics at a price far, far below that of any equivalent machine was a logical step to take, especially in view of Sinclair's obvious annoyance at being left out of the BBC deal.

What is interesting, though, is that the Spectrum does not replace the ZX81, as the 81 did the 80 — it's an addition to the range and the ZX81 will continue in production. In fact, production of the 81 is to be *increased* to a target of 150,000 a month by the end of the year.

'The ZX81 will continue to be ideal for the person who wants the lowest possible entry cost into computing,' says Sinclair. And to prove the point, he's knocked $35 off the price of the 16k RAM pack.

At the moment Spectrum is available only by mail order and is only on sale in the UK — there are no plans yet to market it through retail outlets, as is done with the ZX81 through W H Smith, and export versions are not planned until the end of the year, with the USA being the first (and largest) market to get the new machine. —*Peter Rodwell*

about the hardware. It is a very professional job; looks smart, works well and manages to squeeze 191 legends on to just 40 keys!

Firmware

Here's a new section for *PCW* Benchtests. All the software on the review machine was in the ROM chip which also contained the character set. This time Sinclair has gone for a basic ASCII set (upper and lower case) with the addition of both built-in and user-defined graphics characters. Outside of the range SPACE to QUOTES (32 to 126), many of the codes have special values relating to Spectrum keys and functions. For example, you'll find a copyright symbol key. (Now why didn't anyone else think of that?) You can define up to 21 characters of your own.

Two screen tables are maintained in memory — one for the displayed characters themselves and the other for the attributes which describe how they're to be displayed. These attributes can be tested from within a Basic program. The character colour is referred to as INK while the background colour is called PAPER. Isn't that sensible? Each character can have its own value for INK, PAPER, FLASHING, BRIGHTNESS, INVERSE and OVER. The last two should be explained: INVERSE simply means that the dots which form the character are printed in the PAPER colour while the PAPER is printed in the INK colour. OVER is special: it allows you to merge a new character with the one already at the screen position. The rules are that two INKs or two PAPERs print PAPER otherwise it prints INK. This means that you have a neat way of removing the last thing printed and restoring what was there before it.

By now you have probably realised why it is best to stick to two colours when doing graphics work. Since the colour of the INK and PAPER relates to a whole character position, then each time a new colour graphics point is set, all other set points within the boundary of that character are set to the new colour. This makes for a very curious effect to say the least.

Mathematical accuracy is to 9½ decimal digits and a fairly full range of mathematical functions is accessible from the keyboard. While on the subject of keyboards, this one has a built-in software 'click', an upper-case lock key and automatically repeating keys. Like the ZX80 and ZX81 before it, the Spectrum makes great use of single stroke keyword entries. In fact, I think every standard function and command is obtainable in this way. You'll even find things like >= and <= occupying their own pieces of grey rubber.

Basic

The Spectrum comes with a very useful version of Basic. It will be quite familiar to anyone who is used to the Microsoft types of Basic and a doddle to learn for those new to the language.

Rather than go through all the features and functions of the language, I have summarised them in a separate box. Here, I'll just comment on the unusual and interesting aspects of this particular implementation. Unlike some Basics, it is a teeny bit strict about things like using LET before assigning a value to a variable name or putting GOTO after a THEN. My view is that this is all jolly good discipline and it is more than compensated for by the fact that Spectrum pops in all those spaces which make programs so much easier to read. Of course, once you've found your way round the keyboard, the single stroke keyword entry is a joy. (I've got a feeling I said that in my last two ZX reviews.)

SAVEing and LOADing cassette tapes gives plenty of scope on this machine. You can save a program normally, you can save it so that execution starts automatically when it is reloaded, you can save arrays, you can save particular chunks of memory and if you want to keep a pretty picture you've created then you can use the SCREEN$ option to save that too. All saved programs can be verified after saving. The screen save can't be verified because the display is changed during the verify program and it would not then match that held on tape. The LOAD command can, of course, handle any tape created by SAVE. The MERGE command allows you to merge a program on tape

Spectrum Basic

Functions

ABS	ACS	AND	ASN	ATN	ATTR	BIN	CHR$	CODE
COS	EXP	FN	IN	INKEY$	INT	LEN	LN	NOT
OR	PEEK	PI	POINT	RND	SCREEN$	SGN	SIN	SQR
STR$	TAN	USR	VAL	VAL$				

Operations

+ − * / = > < <= >= <>

Statements

BEEP	DATA	GO TO	LOAD..DATA	OVER	RETURN
BORDER	DEF FN	IF..THEN	LOAD..CODE	PAPER	RUN
BRIGHT	DELETE	INK	LOAD..SCREEN$	PAUSE	SAVE
CAT	DIM	INPUT	LPRINT	PLOT	SAVE..LINE
CIRCLE	DRAW	INVERSE	MERGE	POKE	SAVE..DATA
CLEAR	ERASE	LET	MOVE	PRINT	SAVE..CODE
CLOSE	FLASH	LIST	NEW	RANDOMIZE	SAVE..SCREEN$
CLS	FOR..TO..STEP		NEXT	READ	STOP
CONTINUE	FORMAT	LLIST	OPEN #	REM	VERIFY
COPY	GOSUB	LOAD	OUT	RESTORE	

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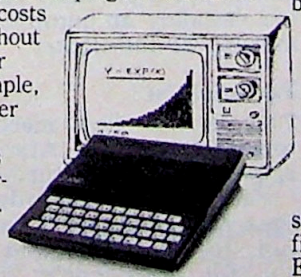

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Technical Data

CPU:	3.5 MHz Z80A
Memory:	16k Dynamic RAM, 16k ROM, 32k expansion option
Keyboard:	40 keys rubber moulding. 183 functions + 8 colour labels. Auto-repeat
Screen:	Domestic colour television. 8 Colours or 6 grey shades.
Cassette:	Domestic recorder.
Disk drives:	To be announced. 100k per drive.
Ports:	To be announced. RS232 & comms.
Language:	Basic in ROM

Benchmark Timings

BM1	4.8
BM2	8.7
BM3	21.1
BM4	20.4
BM5	24.0
BM6	55.3
BM7	80.7
BM8	25.3

All timings in seconds.

with one already in memory. Program lines which are duplicated are overwritten while all others are suitably interleaved.

The graphics facilities are great fun. You can draw straight lines, curves and circles on the 176x256 pixel (PICture ELement, or dot) window. Position 0,0 is at the bottom left-hand corner of the screen. You can define up to 21 graphics characters of your own which is a superb feature if you're into writing your own Space Invader or Pack-Man games. I had a lot of fun drawing and animating little people on the screen. The nice thing is that you can do all this sort of thing without leaving Basic. A BIN (binary) notation has been introduced which allows you to define numbers as a series of 0s and 1s — just the ticket for designing funny characters. Each character comprises eight lines of eight points, so a succession of eight BIN numbers is all you need to define such a character. Another use for user-defined graphics is to squeeze some extra colours out of the machine. If you lay out the 64 pixels like a chess board and choose suitable INK and PAPER colours then you can get some interesting effects. Most of them will be awful but persevere — some will be good.

You won't be surprised to learn that line drawing and circle plotting are achieved using the DRAW and CIRCLE commands. A PLOT command allows you to plot single points. POINT enables you to find out whether a particular pixel is set. You always DRAW from where Spectrum thinks you are on the screen. For example, a command DRAW 10,10,pi would draw a semi-circle ending up 10 places to the right and 10 above the current position. A fraction of pi would provide a different arc while zero, or no third argument (DRAW 10, 10) would draw a straight line. The curve can be drawn on either side of the centre line by making the third argument a positive or negative number.

The CIRCLE command uses three arguments: x-axis, y-axis and radius. Remember, the OVER command can be used to erase something already drawn. I used this feature in conjunction with DRAW, PLOT and CIRCLE to create cartoon effects. OVER is also useful for embedding text in a drawing. When set on, the text merges with the existing lines in the drawing. When set off it prints the full 8x8 character, completely replacing anything already displayed at that position. Incidentally, SCREEN$ can be used to return details of the contents of a character position. Used in conjunction with the PRINT AT command, this could be a good way of making your program find a suitable place to print a sort of 'label' on a drawing. The AT allows you to define the row and column at which printing should start.

A few instructions I particularly noticed as I went though the manual were READ, DATA, RESTORE and VAL$. READ and DATA are old friends although I can't remember them being on previous ZX machines. Using the DATA command you can provide lists of information at the beginning of a program. Each READ instruction takes the next word from this list. RESTORE can be used to set the DATA pointer to any DATA statement. VAL$ baffles me — it strips the outside quotes from string expressions and returns the string value of the result. Perhaps some kind reader would care to suggest a worthwhile application for this feature.

Now let's have a look at our honestly named friend, BEEP. There's not a lot to tell, really, except that you can control both pitch and duration. Notes below middle C are represented by negative numbers, those above by positive. Twelve numbers make an octave. (If you look at a piano keyboard you'll find that there are seven white notes and five black notes per octave.) Middle C is zero. The duration is expressed in seconds or fractions of a second. As I mentioned earlier, the sound isn't brilliant but it has the saving grace of being fairly quiet (ComputerTowns please note). You can pick this sound up from the cassette ports if you so wish. I'd say these facilities are more likely to be used for sound effects than composing symphines.

That's really all I have to say about the Basic. It is a very good implementation for a machine of this size. A PAINT instruction would have been nice to fill in graphics shapes, but I think it would look a bit weird in multi-colour mode with the colours changing at each character boundary. A routine to do this should be simple enough. I think the screen resolution is quite adequate for most personal users of the machine. In fact you can churn out some quite stunning effects using DRAW, PLOT, CIRCLE and the user-defined characters.

Before moving on to documentation, here's a list of the disk commands just to whet your appetite: CAT, CLOSE, DELETE, ERASE, FORMAT, MOVE, OPEN. CAT is probably short for Catalogue which lists the files on a disk. MOVE probably copies a file from one place to another. The others are self-explanatory.

Documentation

Two manuals come with the Spectrum — a thin but useful introduction for the complete novice and a thicker one which explains things in depth. A lot of effort has been put into this latter manual. It is professionally presented and easy to read. Unfortunately, I was given a photocopy of the final proofs and it contained no index and no table of contents. I read the whole manual a couple of times before starting the review and I found it a real problem to find things that I knew where there somewhere. I must admit that the style wasn't to my liking; it's a little verbose and the individual chapters seem to lack structure. I also found the inevitable errors which might cause a beginner problems — things like a minus sign being printed instead of equals, for example. The manual certainly seems to cover everything, so if a table of contents and a comprehensive index are added you'll probably find it adequate. It's certainly an improvement on many manuals on the market.

Potential Use

This is the first machine that I've reviewed since the Atari two summers ago that I would actually buy — in fact I will have probably ordered one by the time you read this. I would use it for fun, for fooling around with graphics and for programming in Z80 code. I would treat it as a hobby machine, a way of relaxing. My children have already become very interested in the

graphics capability and I see this as a way of giving them a real understanding of mathematics. A Logo system on this at the right price would go down an absolute treat — if anyone out there thinks of doing it, I'd love to review it. Of course, there are those who want to learn to write programs. Once again, this is an excellent machine to cut your teeth on. I think that schools and homes have got to be the prime targets for Spectrum at the moment.

Later on when the disk drives appear, this may change. At a predicted $88 for a 100k drive, a lot of people who will have written the Spectrum off as a hobby machine will have to think again. Add to that a $35 combined RS232 and communications facility, and you could be talking about some very interesting and fairly sophisticated networks. At that stage, it becomes a very real prospect for schools looking for a fairly grown-up system, but one which can involve as many pupils as possible. At Sinclair's prices could we possibly be heading for the 'one on every desk' scenario painted by so many futurologists?

Until those disks arrive there is no great office potential for the Spectrum. Once they're on stream then it's probably just a question of appropriate software. Information management and Visicalc-type applications would seem to be the most likely and, because of the price of the television, they will probably be used with portable black and white machines. No doubt the dedicated will take their Spectrums (or is it Spectri?) home to plug into the colour TV. Most people will probably wait until Sinclair announces a flat screen colour television. The network idea could then be useful in offices for things like telephone directories, noticeboards and memos.

Prices

16K Spectrum	$220
48K Spectrum	$310
32K Memory	$100
Microdrive disk	(estimated) $88
RS232 + Comms	(estimated) $35
ZX Printer	$100

Conclusions

Well, for the benefit of those who only read the first and last paragraphs of these reviews here are my conclusions: Clive Sinclair has produced a very good 16k personal computer which offers colour, high resolution graphics and limited sound for just $220. That represents very good value for money provided that this is the sort of machine you want. It is ideal for people who want to learn about computing and have a lot of fun while they're doing it. Given the right sort of graphics-based educational software, it can bring people very pleasurable ways of learning subjects such as mathematics and geography. Once the games programs start to appear, a lot of people will use it just for that, although it does seem a bit of a waste.

Later on, the provision of disk drives and communications facilities will make it an even more serious contender for the school markets and it will begin to creep into businesses. When the flat screen television appears then I suspect that the business interest will rise because the price will be far more appropriate. Bulletin boards, memos, telephone directories, spreadsheet calculation and information management seem to be the most likely applications.

The 'proper' keyboard is a distinct improvement on its predecessors, but it still doesn't achieve — or try to achieve — the quality of an IBM. All the old regular Sinclair features are included — the single keyword entry and the automatic syntax checking as you enter each command, for example.

My verdict? The best value for money you can find today! □

I would like to thank John Mathieson of Sinclair Research for so patiently answering my questions.

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How To Buy a Personal Communications Station

Mike Coffey

As a terminal buyer, you will find many options with widely varying price tags in the marketplace. This article discusses the most commonly found features, and gives hints about prices.

The world of electronic communication is reached through terminals. The word "terminal" is difficult to use because terminals come in many different forms. The primary choice for personal communication is between basic terminals and personal computers.

Although data processing experts frequently refer to "intelligent terminals," "smart terminals," and "dumb terminals," they have not defined the differences between those terms. In this column, all terminals that are not computers will be referred to as "basic terminals" or just plain terminals. Computers that communicate can also be referred to as terminals, since they perform all the functions of basic terminals.

The personal computer is distinguished from the basic terminal by the operations it can perform on data before and after transmission. The basic terminal can display and/or print data as it is received, but cannot store the data, retransmit, or edit it.

Personal computers equipped for communication generally cost more than $500 and can cost over $5000. These systems can be customized and are, therefore, very desirable for the serious (many hours a week) communicator. Basic terminals range from under $500 to about $1500 in price.

Basic Terminal Systems

All terminals have screens, but these vary in the amount of text they can display at one time. They vary both in the number of lines and in the number of columns that appear. The least expensive terminals use home televisions as screens and display 40 or fewer columns of text. Many other terminals use more specialized screens and display from 66 to 80 columns. Some terminals show 24 lines at a time; others show 16.

Some expensive terminals, costing over $1000, display more than 24 lines and/or more than 80 columns. I have seen displays of as many as 132 columns and 66 lines, but I haven't seen one terminal that does both.

Screen Aesthetics

Many other factors, much harder to describe succinctly, affect the appearance of a terminal screen. The shape of the letters, the colors of the text and of the background, and the angle of tilt are among many considerations. The best way to evaluate screen aesthetics is to take a good look at several screens before buying one.

Many people have theories concerning the relative legibility of various types of terminal screens. Some say that televisions are unsuitable for extended reading, due to glare and fuzziness. Many veteran users swear by green-on-black displays. Others insist on black-on-white. I am undecided.

Keyboard Format

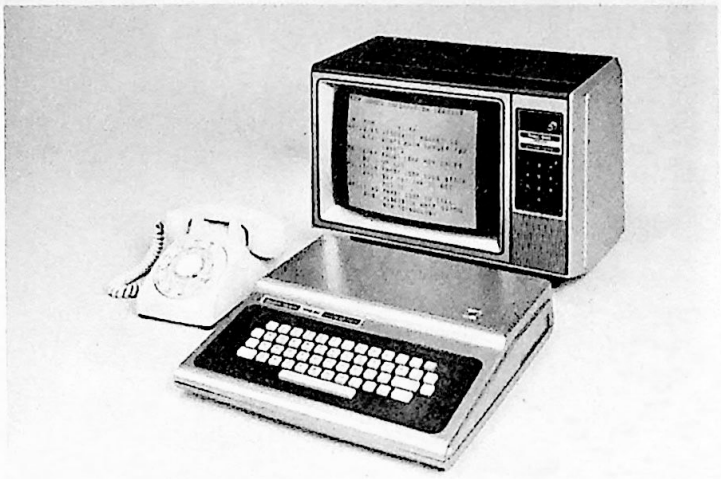
Terminal keyboards resemble typewriter keyboards with extra keys. Some have only a few extra keys, others have a dozen or more. The extra keys that everybody needs include Return, Control, and Escape. New types of keys are invented all the time.

Many terminals include "function keys" that can have different functions for each application. Some function keys are said to be programmable, which means that the terminal user can decide what function each will perform. Others are said to be programmed or pre-programmed, so the remote computer programmers must decide how to interpret them. Most computers do not know how to interpret most pre-programmed function keys.

Shift Lock keys and other frills carried over from fancy typewriters are always appreciated but seldom necessary. Advanced, specialized applications may require advanced, specialized keys, but the keys already described fulfill ninety percent of all requirements.

Keyboard Aesthetics

For extended use, the keyboard must be a comfortable place to rest fingers, and the keys should respond positively to



The Radio Shack Videotex.

The Zenith Z-19.

the user's touch. Some keyboards can be moved independently of the screen, others are permanently attached. Attached keyboards work well in offices; movable ones work best for most environments.

Three classes of keyboard "feel" are available. The flat panel keyboards are the cheapest, the Chiclet style come next, then the full-stroke boards.

For extended use, choose a full-stroke keyboard. That type of board responds like an electric typewriter, although quality varies from model to model.

For many users, the Chiclet style is a good compromise between price and aesthetics. The keys resemble small candy squares and behave like calculator keys. Some experienced typists dislike these keyboards, but they are quite adequate for children and novice typists.

Flat panel keyboards are virtually indestructible. They are suitable for environments in which they are subject to abuse, but suffer from a severe lack of responsiveness. The keys work like touch-sensitive elevator buttons. Very few touch typists enjoy working on a flat panel keyboard.

Telephone Hookup

Terminals connect to the Bell system through devices known as modems, which can be purchased as separate units or as built-in components of terminals. Almost all separately sold modems adhere to a standard called RS-232 which means that terminals and modems are almost universally interconnectable. Modems connect to phone lines in one of two ways: acoustic coupling or direct connection.

An acoustic modem consists of two suction cups attached to a shoe-sized box. Inside the box, a speaker, microphone, and a few circuits conspire to translate digital data from a terminal into sounds for a telephone to pick up and transmit. To use such a modem, you simply dial the telephone and place the handset into the suction cups.

A direct connect modem bypasses the handset of the telephone, translating digital data into standard Bell system signals. These modems are theoretically more reliable than acoustic modems. To use one, you merely flip a switch after reaching the remote computer. Many direct connect modems include convenience features not found in acoustic modems.

The right modem strikes a balance between convenience and price.

There are just a few ugly technicalities to negotiate when attaching a direct connect modem to the Bell system. Touch-tone and rotary-dial systems tend to be incompatible. Also, some business switchboard systems (like Bell's Horizon) have special requirements. The instructions for any modem should state whether it works for touch-tone or rotary-dial systems. For other problems, find a phone expert or simply experiment. You are not likely to damage anything.

Choosing a Modem

The right modem strikes a balance between convenience and price. Adequate modems can be bought for less than $150. Some more expensive models can dial the phone at keyboard command. The fanciest ones can also answer the phone.

Modems that communicate at 300 words per minute, the most common speed, seldom cost more than $350. Modems that communicate at 1200 words per minute usually cost more than $700. Communication speed is generally measured in baud, which is equivalent to words per minute.

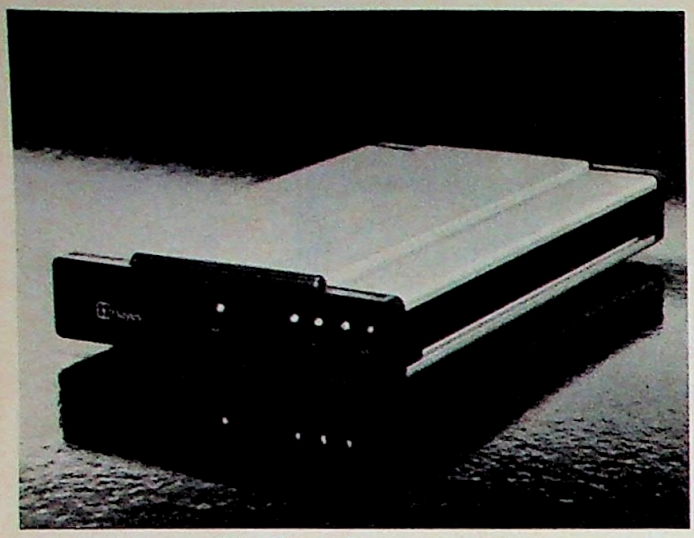
Basic Terminal Examples

Under $500: The Radio Shack Videotex terminal with built-in direct connect modem and Chiclet style keyboard plugs into a home television and produces 16 lines of 40-column text in 16 colors. Radio Shack also throws in subscriptions to the Compuserve and Dow Jones information networks.

Under $1000: The Zenith Z-19 terminal sports a full stroke keyboard with preprogrammed function keys and cursor control keys. The permanently attached screen displays 24 lines of 80-column text in black-and-white or black-and-green. The Universal Data Systems direct connect modem fits like a small paperback book under a phone and connects easily to both phone and terminal. A printer can be added.

Under $1500: The Televideo 950 includes a detachable full-stoke keyboard with rows of extra keys, most of which are programmable. The 24 by 80 character text display contains unusually well formed characters in black-and-white or black-and-green. The text can be made to slide up the screen instead of jumping line by line. Countless other features, many of which I know no use for, are also included. You can add a printer if you want.

Rounding out the under $1500 system, the Hayes Smartmodem can "pick up" and dial a phone under command from the terminal keyboard. A simple cable connects it to the terminal. The modem contains a speaker so that you can hear



The Hayes Smartmodem.

The DEC VT-100.

the ring or the busy signal while waiting for the faraway modem to answer.

The high end: The VT-100 from Digital Equipment Corporation provides 132 columns of text and a deluxe, detached keyboard. This popular and reliable model includes all features mentioned above for the Televideo 950. The VT-100 is used by many people as a standard of comparison for all other terminals. The basic terminal can be upgraded into a personal computer with a kit available from DEC. The VT-100 costs $1945 and the upgrade goes for $2400. A non-upgradeable version, called the VT-101, lists for $1350.

To go with the VT-100, choose the Hayes Smartmodem or any other high quality unit.

Personal Computer Communication Stations

Most of the criteria for selecting a basic terminal also apply to the selection of a personal computer for communication. Personal computer buyers should also look for features that make their communication more effective by providing convenient methods of composing and reviewing messages.

One key ingredient in a PC station is the terminal software, one or more programs that control the computer while you communicate. Terminal programs vary widely both in the features offered and in ergonomic design. The true test of a PC station is to run the terminal software.

Many terminal programs have been written for the most popular computers (Apple II and TRS-80). These range in price from under $40 to over $100. One good selection strategy is to start with a cheap program and upgrade when you have figured out what you really want. After all, everybody wants something different.

Here are some tasks you might want to perform with a terminal program:

- Capture data on disk as you receive it.
- Prepare messages before sending them.
- Maintain a bulletin board.
- Send files from your disk.
- Dial pre-stored phone numbers.
- Type pre-stored command sequences.
- Print text as it is received.
- Review text that has been received.

Terminal programs vary widely both in the features offered and in ergonomic design.

Examples Of Personal Computer Based Stations

Under $600: The Radio Shack Color Computer displays 32 columns of text, can hold over 16,000 characters in its memory, and hooks directly to a color (or black-and-white) television. The Basic programming language is permanently installed and cartridges for text editing, calculating, picture drawing, and game playing can be bought at relatively low cost.

The Radio Shack "Modem I" connects directly to the phone line and is easy to use. That modem can also be used with other computers and terminals, if you decide to upgrade your system. I also recommend the TRS-80 Videotex cartridge, Dow Jones Information Service and Compuserve Information Service, sold by Radio Shack as a combination package.

This is a bare-bones system that is easy to install, comes from a single source, and can be upgraded. You can add disk drives and more sophisticated software as your needs grow.

Under $1600: The Atari 800, combined with an Atari disk drive and the Microconnection modem comprise an unusually flexible and convenient communication station that displays 24 lines of 40-column text on a color or black-and-white television.

Like the TRS-80 Color Computer, the Atari contains over 16,000 characters of data storage and the Basic programming language. The inclusion of a disk drive opens the door to a whole world of data processing.

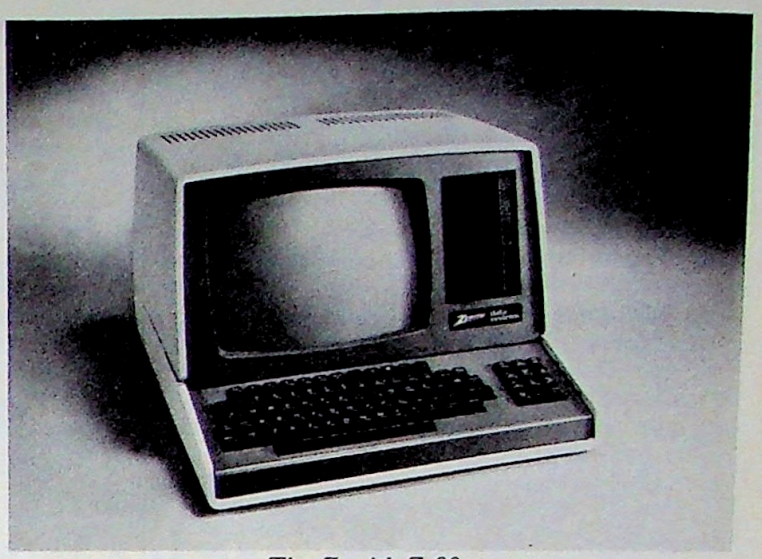
The Microconnection modem and optional Tsmart software, both sold by the Microperipheral Corporation, allow prepared text to be sent over the line. They also enable the computer to record incoming data on a disk. For ultimate convenience, the software memorizes a list of phone numbers that you can dial by tapping just a few keys.

The Atari system also plays superb, colorful games and can be expanded for word processing and many other uses.

Under $3500: The Zenith Z-90 offers an 80-column by 24-line screen and a built-in disk drive that holds over 160,000 characters. Zenith also packs in a very sophisticated version of the Basic language and a spreadsheet program called SuperCalc. The Zenith also has a large (64,000 characters) internal memory, which is very useful for word processing.

The keyboard and screen of the Z-90 resemble those of the Z-19 terminal, described above. Adding a Hayes Smartmodem and a communication program such as CPS (distributed by Zenith) rounds out this flexible computer system. The system is expandable, with high capacity disk drives and many programs available as options.

The Radio Shack Modem I.



The Zenith Z-90.

The high end: Before spending more than $3500 on a personal computer, you should examine carefully all the tasks you want to perform. Besides getting a comfortable screen and keyboard, you may look for graphics capabilities, storage capacity, and options.

Final Words

You should keep in mind that many other products are available in each category. In particular, the $1600-$3500 computer market is jumping with fresh, new products. Also, the used terminal market is very vigorous, particularly in college towns.

I have said nothing about why you should buy any of this equipment or what you should do when you get it. Ask your computer store friends about bulletin boards in your area. Bulletin boards are free services provided by computer hobbyists and retailers. You can call a bulletin board, read messages stored on it and leave messages for other users.

Compuserve, Dow Jones, and Source Telecomputing all provide interesting information priced from $5 to $12 per hour, not including phone company charges. You reach them, in most cases, by dialing a local telephone number. Exploring these databases can be very entertaining and educational. Compuserve and The Source also allow person to person and bulletin board style communications. □

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CIRCLE 196 ON READER SERVICE CARD

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Smartmodem 1200 is two modems in one. Like the original Hayes Smartmodem, it can communicate with other Bell 103 type modems at up to 300 bps. Plus it's a 1200 bps modem for communicating with the faster Bell 212A type modems. Unlike many 1200 bps modems, Smartmodem 1200 lets you select full or half duplex, for compatibility with time-sharing services or any other system you choose. Smartmodem 1200 allows you to access The Source,℠ communicate with your branch offices, or exchange programs with other computer users. In fact, it performs just about any communication function you can imagine, and can be program controlled using any language.

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CIRCLE 138 ON READER SERVICE CARD

Communicating on the Run

Glenn A. Hart

Microcomputer enthusiasts sometimes feel like guerillas with a set of multiple personalities. At every corner we find ourselves participating in one revolution or another—the advent of the microcomputer itself, major changes in the educational process, electronic mail, control of our environment with advanced electronics, Electronic Funds Transfer and the "cashless society," and many others.

One of the widest ranging is in telecommunications. From corporate giants battling over satellite channels, newspapers pondering the future of paper vs. computer publication, the financial community restructuring its procedures and information flow down to the microcomputerist exchanging programs over public bulletin boards, the telecommunications revolution will have a tremendous effect on the life of every citizen.

Telecommunication Basics

Our microcomputers have given us early access to many of the elements of this burgeoning field. Historically, computers have used telephone links in several ways. When time sharing of mainframes and minicomputers was the order of the day, connections to these systems from remote locations was important. This led to the development of the modem, a contraction of the words MOdulator and DEModulator. The function of a modem is to translate information in a computer to audio tones which can be transmitted over phone lines (the modulation part) and re-convert these tones into a form which a computer can understand (demodulation).

The advent of large scale integration and other techniques has allowed hardware designers to cram an incredible amount of circuitry into very small enclosures.

The limitations of the telephone system impose various restrictions on this process, especially in terms of the rate at which the data can be sent and received. Early modems operated at a transfer rate of approximately 30 characters per second (300 baud), and this is the common rate still used today. More expensive devices are available which can operate at 120 characters per second (1200 baud) over the public telephone network, and there are even higher rate devices used in business, but the norm is still 300 baud.

There are two main types of modems, acoustic and direct-connect. An acoustic modem requires that the telephone handset be placed into cradles which attempt to isolate it from the sounds in the surrounding room. Speakers and microphones in the cradles create and receive the audio tones, which circuitry in the modem converts to the signals needed by the phone line and the computers. This can work reasonably well, but deficiencies in the phone set, the difficulty in getting solid coupling and room noise make the performance of such modems spotty.

Direct-connect modems, as their name implies, hook up directly to the phone line without any acoustic coupling at all. This eliminates many of the problems of an acoustic coupler and results in much better performance, assuming, of course, that the connection is possible. Since the restrictions on connecting equipment to the phone system have been eased, direct-connect modems have more or less taken over the market, although certain portable applications still require acoustic coupling (in a phone booth or in a customer's office, for example).

To use a modem, a microcomputer needs a serial data port, almost uni-

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versally included with a basic system, and the appropriate software. Various levels of sophistication are available in the software, the best of which allows automatic transfer of files and many other convenient features.

With the proliferation of modem equipment, a wide spectrum of services has become readily accessible. Commercial services like CompuServe and The Source include wire service information and articles from several major newspapers, financial information, buying services, electronic mail, programming languages, games and much more.

Specialized financial systems provide investor information and up-to-the-minute stock quotations. Many commercial databases can be accessed by professionals. The microcomputer community itself has established public access bulletin boards, both general interest and devoted to special applications or hardware. In addition to providing a public forum for interchange of information, many of these systems also serve to exchange public domain software, and some even feature full remote control of the host system.

"Portable" hardware to access remote computers has been available to the business community for many years. Most of the devices have been printing terminals with a full size keyboard and some sort of thermal or impact printer, fitted into a special carrying case. While such machines can be carried around and hooked up to any phone line through their acoustic couplers, they require AC power, and tend to build up upper body muscles with their not insignificant weight.

The advent of large scale integration and other techniques has allowed hardware designers to cram an incredible amount of circuitry into very small enclosures. Over the past couple of years such technology has been applied to small, battery operated terminals which can access the phone lines just as their bigger brothers do. Many major corporations use such devices for remote entry of sales orders and other information.

Hardware

The new IXO Telecomputing System is such a terminal device, but with many advanced features which make it a pleasure to use. Looking much like one of the new breed of hand-held computers from Radio Shack/Sharp, Panasonic and Hewlett-Packard, the IXO measures 7-1/4" x 1-1/4" x 4-1/4" and weighs just under one pound. A single line liquid crystal display has a capacity of 16 upper case characters formed in a 5 x 7 matrix (lower case letters can be sent out but any lower case characters received are converted to upper case internally for the display).

A full duplex, 300 baud, originate-only, direct-connect modem is built in, and is connected to the phone line with a standard modular jack (adapters to the older four prong jacks can be used if needed).

The modem is capable of full auto dialing, and uses a clever mechanism to employ either pulse dialing or touch tone automatically depending on the capabilities of the phone line to which it is connected. It first tries touch tone, but if a dial tone is still present after two tones the unit switches to 10 pulse per second standard dialing. If a carrier tone is already present, the terminal bypasses dialing altogether and enters the communications mode.

When not hooked up to a phone line, power is provided by a flat 6-volt Polapulse battery. This is a new device based on the batteries designed by Polaroid for the film for the SX-70 camera line and is now used in the film packs for several Polaroid models.

When the IXO is attached to a phone line which is "off hook," the phone line itself provides all necessary power. The telephone system requires all devices to draw a small amount of current to indicate that they are on, and this is more than sufficient to drive the low power CMOS processor and memory in the IXO.

The entire session proceeds in very human, conversational terms.

The IXO keyboard is laid out in standard typewriter fashion and can generate all 128 standard ASCII codes. In addition to the normal keys, several special function keys, which do not appear on any device previously available, are included. These keys are an indication of the primary factor which makes the IXO unique: its human engineering.

Human engineering, user friendliness, ergonomics and other phrases are different expressions of a new emphasis on the way both hardware and software interact with the user. The idea is to make equipment and programs easy to use through careful consideration of the user's anatomy and mental processes. Products which are designed along such lines require much less documentation and can be used without extensive training.

Another way of putting it is that the user should be shielded from unimportant or highly technical details wherever possible and simply be comfortable in operating the product. The IXO designers obviously subscribe very much to these principles. Many features which make telecommunications easier and more transparent to the user are incorporated into the IXO.

Getting Started

The first time the IXO is used, two options are available: either calling the special IXO Access Center or manually accessing the computer of the user's choice. After pressing ON/OFF, the display asks IXO ACCESS CENTER? Pressing the PHONE key displays ENTER NUMBER. IXO provides a listing of the local numbers for Tymnet, a nationwide service which ties computer systems together through local numbers. The user enters the local number and hits the ENTER key.

A small speaker built in to the unit allows the user to monitor the dialing process to determine if the line is busy, and also provides various tones to audibly reinforce various operating conditions and key presses. If the connection is completed, the initial carrier tone is heard and the phrase ON LINE appears on a small annunciator at the top of the LCD display. The main part of the display now shows LOGGING ON, and the log in process proceeds automatically.

This auto logging is a most unusual procedure. Gaining access to most systems requires varying amounts of identification and other information, usually in a manner unique to each system. Thus the user of many different systems needs to remember the exact procedure for each.

The IXO Access Center conducts a highly conversational, easy to understand dialog with the user. This first contact serves to register the specific unit by requesting information on date and place of purchase and serial number. Next a password is chosen and additional information about the user is requested, including his birthdate and mother's maiden name.

When the contact is complete, the Access Center will download this password and the user's name to the individual Telecomputer. Once this has been done the unit will address the user by name and request the password every time it is turned on. Without the correct responses the Telecomputer will be virtually unusable, providing an excellent measure of security. The personal data requested in the initial Access Center contact allows a forgetful user to call IXO and request a reprogramming.

The Access Center next offers to down-

load the sign on protocols for several common telecommunications services and databases, including The Source, CompuServe and Dow Jones. If this service is chosen, the Center asks for the number of your major credit card (there is a $6 charge for this service) and downloads the protocols. Thereafter, when the IXO is turned on, the user is prompted for each service; a YES response dials the service and automatically logs the user on.

The entire session proceeds in very human, conversational terms. The user hits the YES, NO, DON'T KNOW and ENTER keys as appropriate. The CLR CHAR and CLR ENTR keys can be used to correct either individual characters or the entire response prior to hitting the ENTER key. The HOLD key stops the information scrolling past on the display. An annunciator displays ON HOLD and a ticking sound emanates from the speaker as a reminder of the HOLD condition. This continues until the HOLD key is depressed a second time.

SLOW and FAST alter the rate at which information appears in several discrete steps. When either key is pressed a sound is emitted from the speaker until the extremes of speed adjustment are reached. REPEAT redisplays information which has already scrolled by, up to the last 80 characters. Finally, GO BACK returns the user to the previous menu selection.

IXO is lobbying for their protocols to become a standard interface in terms of both the sign-on procedures and the special keys provided on the Telecomputer itself. These keys, by the way, put out very simple codes (YES = Y cr, NO = N cr, DON'T KNOW = ! cr, HELP = ? cr, GO BACK = cr, CLR CHAR = BS (redefinable), CLR ENTR = CAN), so there wouldn't be any problem in other systems adopting the IXO suggestions or in users of non-IXO equipment generating the same codes.

Once downloading is complete, the IXO cycles through the downloaded services and allows the user to access his choice automatically. The first time a downloaded service is reqested the user is prompted for the phone number to use; the IXO remembers the number and doesn't need to ask for it again thereafter, making access totally automatic. The option of MANUAL ACCESS is always offered, allowing access to literally any computer system which permits 300 baud connection.

Obviously, not all systems will recognize the special IXO codes. The SLOW and FAST keys use a standard handshaking protocol of XON and XOFF to control scrolling speed, which fortunately is recognized by almost all host computers. Some of the other IXO features are dependent on the IXO hardware itself, so these work on all systems.

The Telecomputer display is designed with several useful characteristics to improve readability. For example, the display clears when a line feed is received and pauses when several punctuation characters like period, comma, hyphen or colon appear.

Pros and Cons

How does all this work in practice? Absolutely beautifully! The ease in accessing systems is marvelous. I have allowed several people totally unversed in computers or telecommunications to try the unit, and all have succeeded in making connections and conducting useful sessions without any problems (at least any caused by the IXO). I have accessed a large number of widely divergent services with only minimal difficulty.

The IXO worked perfectly during my evaluation, without any technical problems at all. The display is easily readable, especially with the speed controls to adjust the scrolling to a comfortable rate.

The IXO Telecomputer does what it sets out to do in excellent fashion.

The keyboard has a nice touch and the size of the keys is larger than most hand-held units (although still a bit too small for long sessions or really fast touch typing). The IXO inclination for human engineering also shows in the keyboard, with the color coding and sizing differences of the keys quite helpful in directing the user to the desired areas of the keyboard. Some users found the Space Invaders sound effects the IXO emits a bit distracting, while others found them helpful reinforcement of what was happening.

If there is one major weakness in the unit, it is the lack of any archival storage medium such as audio cassettes or even minidisk or bubble memory. Without any storage capability the uses of the unit are less broad than a normal microcomputer with a modem and good software, in that no information can be accumulated for transmission to the remote computer and no programs or other data can be downloaded. Thus, a salesman in the field, for example, cannot store his day's activities on some medium and transmit it home, and cannot receive information from the host without manually writing it down on a piece of paper.

IXO has announced several peripherals for the Telecomputer which will at least partially alleviate this situation. A 20-column 40-character per second thermal printer will produce hard copy (but only where AC power is available), and an RS-232C interface will allow connection to larger printers. A video interface (also requiring AC) will display 16 lines of 32 characters on a video monitor or standard television set.

Finally, an acoustic interface is currently available which allows use of regular telephones where a modular jack is not available. Note that this last unit is not the same as a regular acoustically coupled modem, since the modem is already built into the IXO.

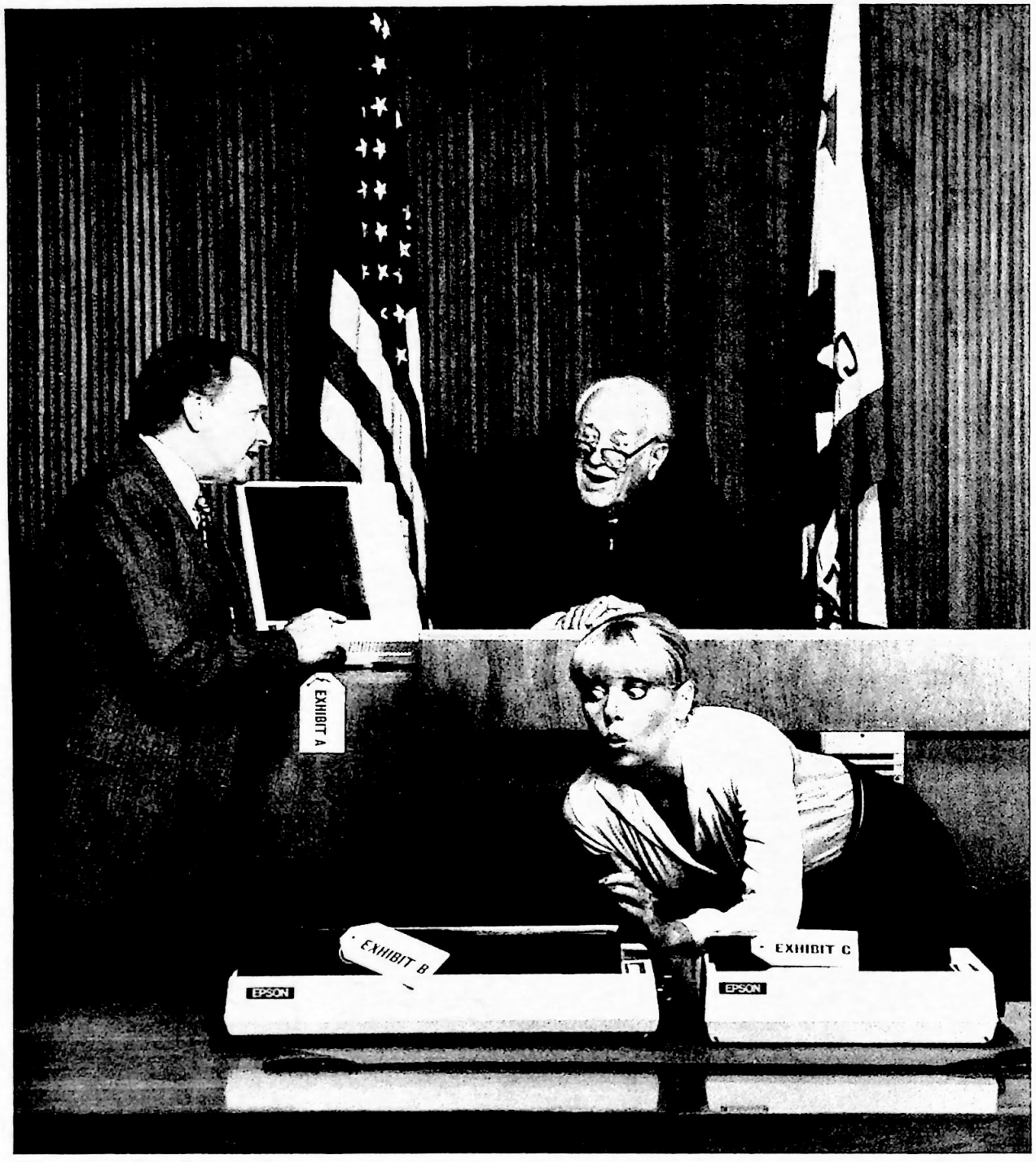
None of these devices was available for review. Since the IXO Telecomputer has only a simple two-connector jack to connect the peripherals, it is fair to assume that only one external device could be hooked up at a time. In any event, IXO had not announced any storage device at the time this article was written.

The Panasonic/Quasar hand-held computer offers an acoustic modem as one of its peripherals and has the power to transmit or download programs from or to memory, although it does not yet have a cassette or disk device available either. The Sharp/Radio Shack 1500/PC2, which does have cassette storage, will be offering this fall an RS-232 adapter which would allow connection of a modem, assuming the likely release of appropriate software for the interface. Both handhelds include printers which can work from battery power and have bus structures which allow more than one external device to be connected at a time. Thus either of these handhelds might be considered to offer added capabilities compared to the IXO, although without the wonderful human engineering and specific telecommunication features built into the Telecomputer.

In summary the IXO Telecomputer does what it sets out to do in excellent fashion. Considered solely as a telecommunications terminal it works exactly as advertised and brings a new ease and simplicity to accessing remote databases and computer services.

The protocol ideas being promoted by IXO are excellent and hopefully will be adopted by a wide variety of services. The IXO is a most desirable device for those who do a great deal of modem work and represents a definite advance in the state of the art in portable telecommunications.

IXO Inc., 6041 Bristol Parkway, Culver City, CA 90230. □



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CIRCLE 134 ON READER SERVICE CARD

A Teeny, Tiny Telecommunications Terminal

Marc Stern

A relatively recent development in the world of computers has been the smart terminal. This type of terminal usually features some type of display, a keyboard and a sophisticated microprocessor. It can also interface directly with a phone line or has external modem capability. It also has ports for peripherals.

Of course, there have been terminals on the market for some time, but they were heavy affairs with little in the way of "smarts." In fact, they were rather dumb, being more slaves to a host computer, rather than microcomputers themselves. These units, which were good for the work they did, were also rather heavy, cumbersome affairs.

This situation has changed as the cost of memory has dropped and as such sophisticated microprocessor units as the Z80 or Z80A have become available for very reasonable cost. Actually, to say the situation has changed is putting it somewhat mildly. It would be fairer to say that the situation has revolutionized the terminal market.

The rather heavy, bulky terminals have given way to a new generation of lightweight, portable terminal units which boast a wide range of sophisticated features. Such units are now being marketed by Novation and Sony, among others.

These units are good for traveling salesmen, field engineers, executives or anyone with a need to contact either someone else or a host computer. Typically, they can be used anywhere from an office in the field to a telephone booth. They can be used for a wide variety of functions and are a good value for the money.

Since these units tend to be user-friendly, little knowledge is needed by the operator. In fact, with only the documentation even the neophyte operator can be up and running in short order.

Specifications

The Infone by Novation is one of these units. It is made to order for the traveling person or the person who wants to work

Marc Stern, 555 Worcester Rd., Framingham, MA 01701.

at home with a host computer. A compact terminal, it fits into a soft briefcase. It is 1 1/2" high, 10 3/4" wide, 7" deep and weighs in at 2 1/2 lbs. Despite its slim size, it carries a great deal of capability, starting with a full typewriter-like keyboard.

The 52-key keyboard features a break mode (key N), upper/lower case capability and special function keys. The character set is full ASCII or Baudot. Special function keys are also included.

The display, though limited to 40 characters, is a one-line liquid crystal 5 x 7 dot matrix display. It scrolls from right to left, much like signs in New York's Times Square, and presents no problem to the user. It also has a cursor.

The central processor unit is an 8-bit Motorola 6802 with 32K of ROM. Since the type of Infone evaluated was the top-of-the-line "Maxi," it had 6K of Random Access Memory space for text. The other Infone models—Executive and TTD (for the hearing impaired)—have only 2K of text RAM.

Since this is a smart terminal, one would assume it would have some sort of message originate/answer mode, and the Infone does. It operates in full duplex, although half-duplex is key-selectable, at 300 baud. The data rate is also key-selectable and can be set at 1200 baud for quicker data transfer. It also features automatic messaging and auto-answer for those times when a user is away from the unit but still wants to send or receive messages.

Also built into the unit is a pencil-thin phone handset. It is able—in the dial mode—to sense a dial tone, return a busy signal and call back. A ringer is also built in and works when it is in the auto-answer mode. An auto-dial feature is also available. The user simply tells it which number to access and call, and the unit takes over. It finds the number, displays it, indicates it is being dialed and alerts the user when a connection is made through an internal speaker. An 8-bit D/A converter is also included for, among other things, accessing pulse-sensed, rather than tone-sensed dialing systems. (Pulse-sensed systems are analog in nature.)

Enclosed in a high-impact plastic housing, it will run off either household current or built-in rechargeable NiCad batteries. Depending on the options attached, the Infone will operate for 60 to 90 minutes on batteries.

Remote Control

To illustrate the potential of the Infone, it features not only built-in phone handset and line connectors, but also an RS-232 C connector. There are also DIN plug inputs for a tape recorder, an optional speaker or printer (an available peripheral) and for the acoustic coupler for conventional phone handsets.

The Infone will also control a BSR X10 remote appliance or light-control module and can be set up to flash a light in another room to tell the user the line is ringing.

Although it's quite a small unit, there is a great deal of power built into the small terminal—far more than meets the eye, including a built-in speech memory with 256 kilobits of ROM, an auto log-on key, and a software terminal parameter setting.

Because of the D-to-A converter, it is also possible to mix both voice and text on the same tape when the Infone is used in conjunction with a tape recorder. In fact, the Infone will accept a phoned-in data dump to tape while it is unattended.

With all of these features it is possible to use this terminal for a great many purposes, including electronic mail. This can be done in the built-in module phone plug or with the acoustical coupler that comes with the unit.

The Infone is an excellent example of the state-of-the-art in terminal-only units.

As noted, the Infone is entirely user-friendly and for the most part self-teaching. Out of the packing box, it is ready for plug-in. It has a large AC adapter which uses BSR circuitry to protect the unit from voltage spikes.

Once plugged in, the CPU prompts the user by directing certain actions be taken. Once those initial actions are taken, the display scrolls through the nine menus built into the Infone. By selecting one of the numbered keys the user not only places the terminal in the mode which that key accesses, but is also shown a menu of the possible choices contained in that menu. Infone guides him through the steps needed to make each function work.

In fact, it only took a few minutes with the detailed instruction book with which the Infone comes to have the unit ready for elementary work, and it took only a couple of hours longer to master all the facets of the terminal.

The instruction manual must also be mentioned. It is a thorough document which takes the user step-by-step through all the routines built into the terminal. It is a very good training tool and Novation should be credited with doing a good job.

Message Creation

From a user standpoint, perhaps the most important feature is the ability to create and store messages. This is easily done with only three keystrokes needed to access that feature. The user then creates a message which is stored in memory. In the message mode, a sub-sub menu takes over to guide the user through all the steps in editing and finalizing the message. He can review the message; delete text; insert text at both the top and bottom of the message, and fix other errors. The message is then stored and can later be accessed and dispatched automatically by another of the functions of the terminal.

In the auto-message mode, in fact, a user can tell the Infone what time to send message, and it will be done automatically with the message-originate mode which transmits at 300 baud. The Infone will also answer the phone automatically, by acting as an automatic terminal in the answer mode. It will take and store messages until a user is ready to read them.

Other niceties of the Infone include the ability to program in special event dates, create and store long lists of items or reminders, and the ability to remind the user of those important events.

It seems this unit will do everything but answer the doorbell (it can even make coffee for you if you have the correct BSR appliance module).

Stiff Keyboard

About the only drawback to the Infone is the feel of the keyboard. Although advertised as having the "same 'touch' as a quality electric typewriter," the keyboard is far stiffer than that. A touch typist would be hard-put to use the keyboard in a speedy manner. Also, the keys are like small rectangular buttons and it is easy for a finger to slip off. However, since the unit is easy to use and makes corrections easily, this is no drawback. It is, I believe, far better than other small micros which use a membrane type of keyboard. The feel of the keyboard, though, is still positive and while a touch typist may have some trouble with it, the average hunt and peck, two-fingered typist won't.

Altogether, the Infone is an excellent example of the state-of-the-art in terminal-only units. Its potential is great and it should be a great deal of use to the person who needs to work with a mainframe computer at home or on the road. It would also make a salesman's life much easier, enabling him to communicate with the home office instantly. And, at about $1100 for the unit, it's a pretty good buy, too.

Infone is made by Novation, Inc., 18664 Oxnard St., Tarzana, CA 91356. □

CIRCLE 306 ON READER SERVICE CARD

Telecommunications for Atari Users

David and Sandy Small

The MicroConnection "Direct-connect bus-decoding" modem for the Atari is an excellent product that I have enjoyed using for the past six months.

Why do I like the MicroConnection so much? What makes it so special in a world of dime-a-dozen (well, actually, around $150 average cost each) modems? Unlike other Atari modems, Atari's own product included, this one does not require the 850 Interface. It is plugged directly into the Atari peripheral daisy-chained serial connection, along with the disk drives, printers, and other devices. The feat of making the modem talk with the serial bus deserves applause.

The Atari has almost no built-in peripheral capability, such as RS-232 or parallel printer ports. It has plugs for four joysticks and a 19200-baud serial I/O port. This port is daisy chained to various peripheral devices. The disks, printers, and other devices communicate through this "serial bus."

The RS-232 interface is marketed by Atari as the 850 Interface Module, and it also connects via this bus. The interface retails for around $160.

The wiring is as follows: The RS-232 device (including modems) connects with one to four ports of the 850 Interface. The 850 is then connected to the standard Atari serial bus, and handles communications between the two.

All the modems I have seen require the 850 because they communicate in RS-232 format, which only the 850 can translate.

It is well designed and the software supplied shows off the hardware well.

But the MicroConnection modem doesn't need the 850.

I personally don't like the 850 and have gone out of my way to avoid owning one. For instance, I connect my Epson printer through the front joystick ports with a $10 cable I built, eliminating the need for the 850 parallel printer interface. So I stayed away from modems, all of which needed the 850, until the MicroConnection came out. (I still don't have an 850.)

The deal seems even better when you use the modem. It is well designed and the software supplied shows off the hardware well. The initial cost is a bit high, compared to other modems, but when the cost of the 850 is subtracted, suddenly it is quite reasonable. Finally, add to this good workmanship and readable documentation, and the MicroConnection becomes almost a steal. Hence, this review.

Options

First, a few words on the available options. The Basic MicroConnection is driven through the 850. Yes, I know, but wait. You can order the MicroConnection with the "Atari Bus Decoding Option," which is what I have been talking about.

Next, you can order autodial/autoanswer as an option. Regrettably the autoanswer doesn't work with the Atari decoding option; the 850-interfaced modem must be ordered to get this. This is because the modem must be able to signal the computer that someone has dialed the number, and that the phone is ringing (ring detect), and that there is a carrier on the line (carrier detect).

However, after talking the matter over with one of the company's engineers at

David and Sandy Small, 11314 Yucca Dr., Austin, TX 78750.

NERO KNEW

Nero was emperor of a lot of land. And of people that wrote a lot of different languages. When in Rome, he had to write in Roman:

ROMAN

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CIRCLE 165 ON READER SERVICE CARD

the West Coast Computer Faire, I learned that with a few dollars of hardware, this option can be added, inputting the ring and carrier-detect information through the front ports. The modem definitely will answer the phone and beep if left configured to do so, and other users can talk to it; the problem is that the computer has no way to tell directly when someone has dialed in or hung up.

Now, leaving the autoanswer for a moment, why on earth would anyone want autodial? I admit that at first this seemed like a real frill. (Am I too lazy to dial my own phone?)

The answer came as I perused lists of hundreds of bulletin boards around the country. Many users have set up their systems as "bulletin boards," best described as electronic versions of the bulletin board at your local market. Anyone can dial in, leave messages, collect personal "mail," or post classified advertisements. There are many systems dedicated to one particular subject—Apples, Ataris, copy protection, ham radio, and others. The folks at the Micro-Peripheral Corp., with typical thoughtfulness, even provide such a list for the user.

With this collection of phone numbers, you can pick the most interesting twenty or so, put them in a program, and have a menu selection of which to dial. The MicroConnection modem will then dial the number for you. On busy boards, it may take a while to get through; but by pressing only a couple of keys, a number can be redialed. I really appreciated this option on about the 100th try for some numbers.

The case is a translucent plastic, enabling you to look into the innards, which I think is kind of neat.

Of course, this adds the possibility of having your machine automatically dial and peruse bulletin boards across the country without your help, saving the output for you to look over later on.

One good way, would be to have your Atari dial the bulletin boards at 3:00 a.m. when the phone rates are low and most other users are asleep.

The Hardware

The modem plugs directly into the phone outlet of the modular style phones. If you don't have a modular phone, no problem; the documentation lists Radio Shack parts which will connect the modem to your telephone line. By going directly to the phone lines, outside noise is eliminated.

There are three buttons and two LEDs on the cover. One is power, with an LED indicator. Originate/Answer determines if the modem is to be used to receive an incoming call or make an outgoing call. Data/Talk controls whether the modem is online. If you have the phone connected with a "T" connection so that both the phone and the modem are on the same line, this allows you to connect/disconnect the modem from the phone line as needed.

The other LED is "carrier detect," which lights up very brightly when the called-to modem answers. I had no trouble seeing either LED, even with a bright light directly above them.

The case is a translucent plastic, enabling you to look into the innards, which I think is kind of neat. Some people I talked to didn't like it; I guess it depends on how much you like hardware.

On the back side of the modem are the lead going to the power supply, the phone connection line, and a DB-25 RS-232C connector. Did I forget to mention that this modem, when used with the Atari bus-decoding option, also provides an RS-232C output to drive printers and other peripherals? Instead of buying the 850 Interface, people with RS-232 printers can get both the printer interface they need and a modem by buying the MicroConnection.

I should mention that the MicroConnection is also available in Apple and TRS-80 versions. Indeed, I can look through the case and see where the Apple card would mount on the circuit board; it is marked "Apple Interface." It is nice to see this company has its marketing act together, and has designed a common circuit board (with plug-in personality modules) for these different machines.

Getting Started

I unpacked the modem and hooked it up. This was very easy; there are good directions supplied in the manual. Next, I loaded the cassette tapes that come with the system, and copied them on disk for faster access.

The first program I tried was Tariterm. This is a dumb terminal program, very similar to Telelink. It allows communication but has little in the way of fancy upload/download functions. It works fine, but it lacks many of the options I would have liked.

Next, I tried TSmart, sold separately, which provides everything I wanted, needed, possibly wanted, or maybe could ever use—the whole works rolled into one program, thoroughly debugged and very easy to use. My compliments to Jim Clark, the author of both programs.

A Note About Reviews

One of the most difficult things to explain to a reader is why a magazine prints so many positive reviews and so few negative ones. Many people think they know why: First, reviewers get goodies showered on them for free by manufacturers, and if they write bad reviews, the free ride ends. Second, magazines depend on advertising revenue, and can't afford to annoy potential advertisers. So, they feel, most magazines stick to positive, uplifting reviews. (I've heard this sort of thing many times.)

Is it true? Well, perhaps for some magazines, but not for *Creative*. I learned what really goes on at the editorial desk this way:

I was sitting wistfully contemplating the rejection I had received on a fairly negative review of some software. I was thinking more or less the above as I asked myself why *Creative* didn't publish many negative reviews. So I thought I would call and find out why the piece was rejected. I did so and learned the real reason, which I thought I'd share here.

"Dave, the review was fine. But the product wasn't much good. Now you know as well as I do that there is an incredible amount of junk on the market compared to the really good software. You also know that we have a limited amount of space in which to print reviews.

Should we print reviews of the garbage, or save that space (and the public's notice) for those products that are really good, and are good buys? Sure, if a product is outrageously bad our readers deserve to be warned. But otherwise, we have to let the buyer beware (except for the things we review positively)."

This made a great deal of sense to me, and accounts for the apparent discrepancy. The policy also excludes a large amount of software I have seen for the Atari from review consideration; if I can't find anything nice to say, best say nothing at all. Not because I don't want to see more products; not because the magazine will lose money; but because it falls into the huge category of "unacceptable products," and there isn't room to include them all.—*D.S.*

Using The Modem

Let me use a typical terminal session to show off both the MicroConnection and local bulletin boards.

First, I turn everything on and enter the program. It takes me to a packed menu of options. I select the autodial menu, then select the M.A.C.E. (Michigan Atari Computer Enthusiasts) bulletin board number. MACE has probably the classiest Atari bulletin board in the country. (Should you want to try it, which I recommend, the number is 313-868-2064, 300 baud.) The modem dials for me; this is a good time to refresh my drink.

After a moment, the carrier detect LED lights up, I press Start, and I am logged in, I select the Save option, and everything I type or that is printed to me from then on is saved into internal memory—some 20,000 characters capacity.

SB- 0096

I look at bulletins, leave a message or two, and generally read up on what's going on.

I look at bulletins, leave a message or two, and generally read up on what is going on in the Michigan group. (As an example, just a few days back I finally learned about the upper two bits of PRIOR and how they effect the GTIA chip, right on this bulletin board).

Questions are also quite welcome and they generally get a fast response. You might consider buying a modem to help you get on to bulletin boards, and tap these resources to get your questions answered.

When I am finished, I log off. Next, I select the Save to Disk option, and save the entire record of what I have done on disk for later printing. (I could just as easily print it out right then and there.) The program is now ready to dial again.

TSmart

The following are other goodies in the TSmart program:

1. It allows off-line text preparation (such as with a word processor or MEDIT), then sends the text at high speed. This saves telephone costs as the text is sent at the highest possible speed.

2. It allows text to be received and saved.

3. It allows programs to be downloaded. A bulletin board sends a program listing to you, you save the listing as it comes in over the telephone, Enter it into Basic, and then RUN it—nice way to distribute software. There is even a standard for loading/saving programs, which the bulletin board can remotely control, should it follow the Forum-80 standard.

4. You can send or receive object (binary) or unformatted files. This is no small trick, as the data must be encoded/decoded and cannot be sent directly.

5. You can transmit two user-defined lines with one keypress—for instance, a log-on password or common command. This saves time and is a convenience.

I will skip some of the more arcane features, and summarize as follows: TSmart does it all and is easy to modify. The manufacturer has kindly not copy-protected the disk; my thanks.

Technical Information

Here is some technical information on the modem for advanced users.

The programs require a 400/800 with at least 24K of RAM. This puts the 400 user in a bind—you need an outside manufacturer's 32 or 48K board. (The program probably could be trimmed, however, to run in 16K.) A disk is *not* required; you can run completely off cassette. The 850 isn't required unless you order the MicroConnection with the option.

The MicroConnection will not work with Telelink or any other software looking for the 850 modem (using device R:). The MicroConnection software I have seen defines a device, M:, and does I/O using that. The cassette on/off line is apparently used, as are the data XMT/RCV lines in the serial I/O bus.

Finally, assembly language is used for the really high-speed sections of the program; a subroutine loads from DOS or cassette, exits to Basic, and from there you RUN the needed program.

Miscellaneous Notes

Tariterm is supplied with the modem, which retails for $239.

TSmart, a program I heartily recommend, is available for $79.95.

I have had no hardware problems with the unit and it seems to work with even quite weak carrier signals. Errors are very rare. The software seems very well debugged, and I have had no problems with it either.

In summary: if you have an Atari, and are interested in telecommunications, the MicroConnection is a very good bet. I recommend it to any user. And if you are a beginner, a modem may be just the thing you need to access the growing number of Atari bulletin boards across the country. This will enable you to ask questions, hear the latest rumors, and in general join an exciting electronic community. □

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CIRCLE 136 ON READER SERVICE CARD

Low Cost Letter Quality Printing

David Mannering

In April of 1981 I reviewed the Centronics 737 printer. It was a significant new product because, with its proportional character set, it could produce very nearly typewriter quality print, and it was the first dot-matrix printer to do so for under $1000. Now, a little over a year later, I have the pleasure of reviewing another printer which is a significant new product for the same reason. The Smith-Corona TP-I printer is the first printer to offer true typewriter quality print for under $1000.

The TP-I is a daisy wheel printer, which means that its characters are pre-formed on a print wheel much the same way that characters are pre-formed on an electric typewriter with a removable type element. The difference is that the characters are arranged around a wheel rather than around a ball.

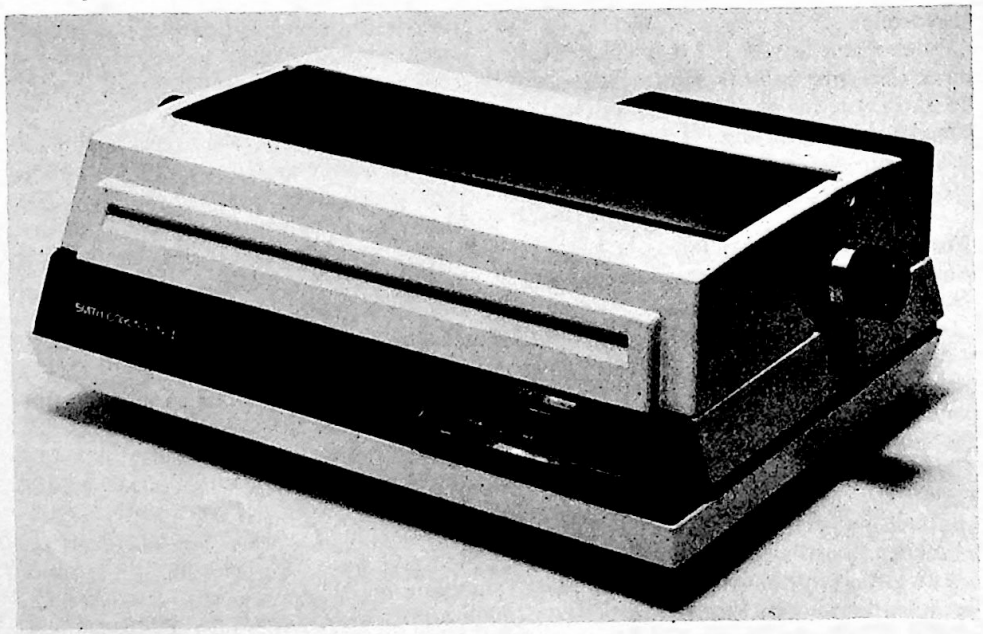
The printer works by rotating the wheel until the proper character is in front of a small hammer which then strikes the letter, forcing it against a ribbon which leaves an impression on the paper. The resulting image on the paper is indistinguishable from that left by a typewriter.

Daisy wheel printers have been available for home computers for a long time, but few home computer owners have been able to afford them; they frequently cost more than the computer itself. The TP-I is priced at $985, which is significantly lower than other daisy wheel printers currently being marketed. It represents a tremendous price breakthrough, which comes as a result of paring down some of the features normally associated with daisy wheel printers.

Physically the TP-I is handsome and sturdy. It has few operator controls, most of which are well hidden. On the front panel there is one switch and one light. In one position the switch sets top of form and in the other position it tells the printer to ignore page boundaries. The light simply informs you that the power is on, which is quite obvious since the cooling fan on the TP-I hums only slightly more softly than my vacuum cleaner.

The power switch is on the back next to the power cord and interface cable. To take the printer off-line (pause the printing) you merely open up the top cover. Printing resumes when the cover is reclosed. Several physical adjustments, such as line spacing and light/dark impression, can be made inside the printer.

Paper loads in the printer a single sheet at a time just as in a typewriter. A tractor feed option for continuous forms has been announced but is not yet available. Although it is possible to use continuous forms with just the friction feed, it is not recommended by Smith-Corona because an uneven paper feed might jam the



David Mannering, 1140 Kentucky, Lawrence, KS 66044.

printer. Multiple part (carbon) paper can be used, and paper up to 13" wide can be accomodated.

The ribbons are supplied in a cassette which is easy to change and is nicely priced at $4.95. Both cloth ribbons, which last a long time, and film ribbons, which make a very dark impression, are available. Daisy wheels may be changed easily and are available in fonts ranging from pica to script. These are priced at $4.95 as well. Both the ribbons and the daisy wheels, however, appear to be different from the ones used by other printers, so Smith-Corona may be the only source of these supplies for a while.

The printer can be purchased with either a parallel or an RS-232 serial interface. I am using the TP-I with an IBM Personal Computer, and it works fine with the parallel interface.

As I mentioned earlier, the price breakthrough on the TP-I is not without its cost. The most apparent thing that was sacrificed in the TP-I is printing speed. The TP-I is rated at 12 characters per second.

The price breakthrough on the TP-I is not without its cost.

If that figure sounds abstract to you then think of it in these terms: at five characters plus one space for each word that would be 120 words per minute, or about twice the speed of a good typist. I recently prepared a 17-page single spaced manual on the TP-I and it took well over an hour to print it. Of course, some of the time was spent loading each sheet of paper.

However, let's be fair and point out that the TP-I is likely to be used for letters and other short documents which need to be high quality, and if you want to print a 20-page Basic program listing you will probably use your second printer (the Centronics 737 you bought after my last review). So, the TP-I is a slow printer, but that may not matter unless you plan to print long documents on it.

Another sacrifice along the way to affordability was made in the software controllable features available on the TP-I. Other than carriage return and line feed the TP-I recognizes only three print commands.

The first command starts and stops underlining, the second sets or clears the margins, and the third sets or clears tabs. These are nice features, but conspicuously absent are such daisy wheel niceties as forward and reverse half-line feeds, which enable a printer to do subscripts and superscripts, and micro-justification.

Micro-justification allows a straight right margin to be maintained by adjusting the width of spaces between each word on the line. Without it, a straight right margin can be maintained only by placing a different number of blanks between words. The difference in effect is enormous. Micro-justified text looks like a professional printing job, while variable-blank text looks as if the typist had the hiccups. If you use a ragged right margin, however, it makes no difference, so the absence of this capability from the TP-I may not matter to you either.

In my review of the Centronics 737 one of my main criticisms was that it had a hard-wired line feed after carriage return, making it impossible to return the print head to the left side of the page without going down to the next line. It became a common practice for dealers to make a small modification to render this feature switch-selectable. The TP-I has the same hardwired feature.

This is becoming a pet gripe of mine now, and I wonder why printer manufacturers do this sort of thing when it seems to be so easy for them to make it optional.

I am using my TP-I with *Wordstar* word-processing software which has many nice features, such as boldface and overprint and underlining. Unfortunately, to do all these things it sends a carriage return to the printer to reposition the print head at the beginning of the line so it can reprint over the same characters. The TP-I, of course, supplies its own line feed with that carriage return and thus goes down a line, completely disabling those features.

Now, I am not defending MicroPro's decision to use a carriage return when repeated backspaces might have sufficed (speed was probably a factor), but Smith-Corona should have looked at the likely uses for their product and made it compatible with existing implementations.

All of the above reservations aside, I like my TP-I and I use it a great deal. I did move it to a different table than the one my computer is on because it vibrates quite a bit. However, it does a fine job in producing a letter quality document, and it does so very inexpensively.

Now that Smith-Corona has set the pace, undoubtedly other printer manfacturers will follow with very low priced daisy wheel printers, but right now the TP-I is in a class by itself.

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CIRCLE 122 ON READER SERVICE CARD

An Affordable Letter Quality Printer

C. A. Johnson

During the last few years, we have seen the prices of dot matrix printers fall dramatically as they improved in print quality and graphics capability. Letter quality printers, those which produce copy comparable in quality to the finest typewriters, have remained costly, averaging about $3000.

Williams Laboratories has just introduced the Bytewriter, a daisy wheel printer truly within the price range of the average personal computer owner. At $795, it has to be the best buy in letter quality print available anywhere.

I am a professional writer, and letter quality print is an absolute must for me if I am to reach the editors I need to reach to make an occasional buck. Since I started using *Scripsit* and my TRS-80 Model I as a word processor, I put my typewriter in storage and used a local word processing service to play out my text on one of their daisy wheel printers. At page rates, this can get expensive, and I had not gotten far enough ahead to buy my own.

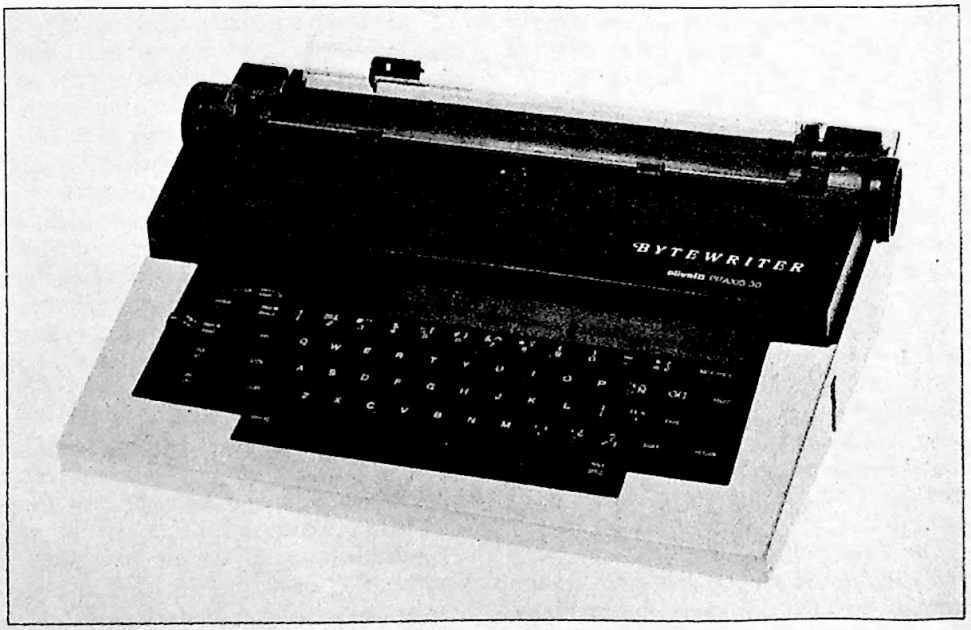
When the Bytewriter was announced, I could not wait to get my order in. I have one of the first production models.

The Bytewriter is built on the Olivetti Praxis 30 portable typewriter. It is fully functional as a typewriter without having to disconnect it from the computer. Just turn it on and start typing. I have difficulty typing because of a touch of arthritis in my fingers, so I do not expect to use my Bytewriter as a typewriter very much, but it is comforting to know that it is still functional.

In addition to the computer interface, a set of DIP Switches has been added to give a selection of 10, 12, or 15 pitch. This selection is not available on the Praxis 30 typewriters. A fourth DIP switch allows the user to select line feed or no line feed with the carriage return. This allows easy adjustment for various software packages which handle carriage returns differently.

Type Styles

Several type styles are available in all three pitches. The daisy wheels are simple to change. Just pull out the one you have been using and snap in another. The character set includes the standard alphabet, numbers, and special characters. In addition, a switch on the keyboard substitutes a second keyboard of foreign



C. A. Johnson, 3619 Sugarhill Dr., San Antonio, TX 78230.

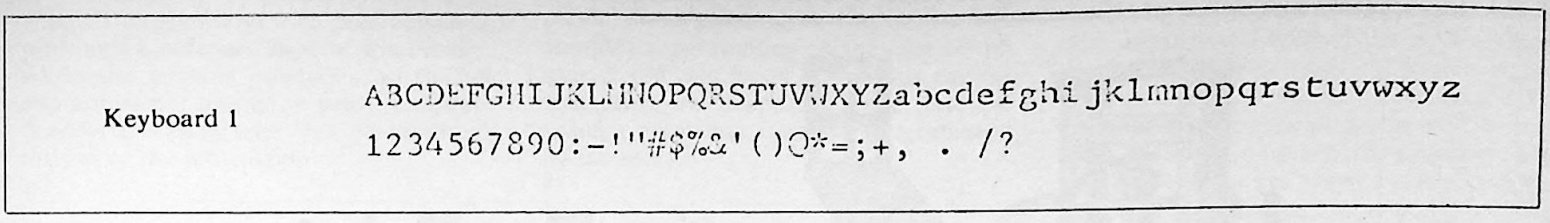
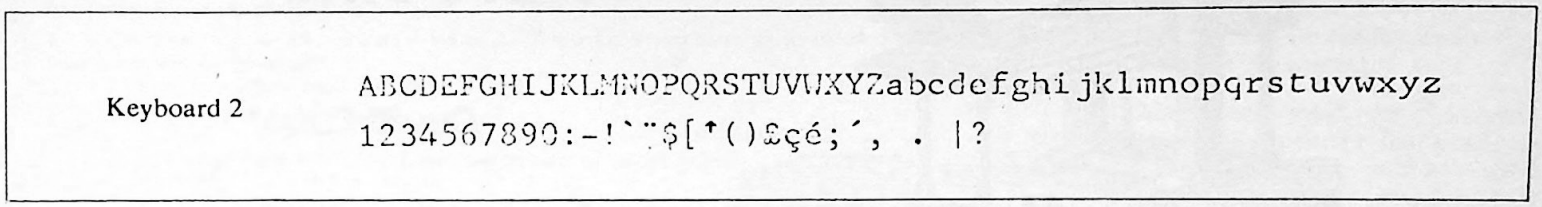


Figure 1. Character sets callable from Scripsit.



grammar symbols for some of the infrequently used ASCII characters (Figure 1).

There are more special characters and symbols on the Bytewriter (Figure 2) than I have on my TRS-80 keyboard or than I can produce with *Scripsit* or *Electric Pencil*. By leaving a space for these additional characters in the text, you can take full advantage of having them available and add them later, manually. In this manner, the Bytewriter can extend the capability of your word processor significantly.

The Bytewriter can provide underlining by either of two means. The backspace can be used to underline as you go, or by calling for a carriage return without a line feed and re-doing the whole line with the underline character where you want it. The ASCII control character "DC2" (control-R) will cause a carriage return without a line feed irrespective of how the fourth DIP switch is set.

My version of *Scripsit* has been modified to underline, using the backspace method. It works so beautifully with the Bytewriter that you would have thought the *Scripsit* patch was designed especially for it.

Although it is no speed merchant, the Bytewriter operates at twice the speed I could type when I was at my best. At 8 to 12 characters per second, it is slow as a computer printer, but considering the cost and the high quality of its print, I find its speed perfectly acceptable.

Parallel Interface

The interface of the Bytewriter is parallel, which is standard, but it uses a 20-pin Berg connector. I was unable to find a ready made cable to connect it to my TRS-80 Interface. Personally, I am less than competent, mechanically. I measure the success of a project, not by how well the project works or how well it looks, but by how much blood I have to shed to complete it. So, I went to the technician in one of the local computer shops to have it made. Five days, six trips, two long distance telephone calls to Williams Labs, and $45 later, I saw my first *Scripsit* text printed on my Bytewriter.

Bytewriter can extend the capability of your word processor significantly.

Cables for the Bytewriter are now available from all Bytewriter dealers for $35. There are cables to fit TRS-80 Models I, II, and III, Apple II (if the parallel printer interface board has been installed), Osborne 1, and IBM Personal Computer.

One item of real concern for microcomputer owners is maintenance of their systems. This is not a problem with Bytewriter. For service on the typewriter after the warranty has expired, the circuit board can be unplugged and removed, leaving the typewriter unmodified except for the added cable connections. Any Olivetti service center can service the typewriter mechanism. Problems with the circuit board can be handled on an exchange basis by the Bytewriter dealer. This can be a real boon in those rare, unfortunate times when service is needed.

I am delighted with my Bytewriter. It produces beautiful copy with either carbon film or fabric ribbon. The type is clean and sharp. I doubt that the most expensive typewriter on the market could produce finer copy. Now that I have discovered the convenience of being able to produce top quality copy when I want it, I would not be without my Bytewriter.

The Bytewriter is produced and marketed by Williams Laboratories, 125 Northview Rd., Ithaca, NY 14850. □

CIRCLE 307 ON READER SERVICE CARD

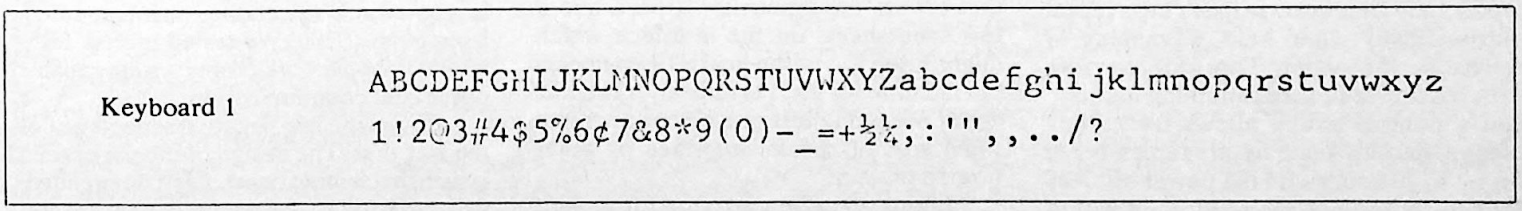
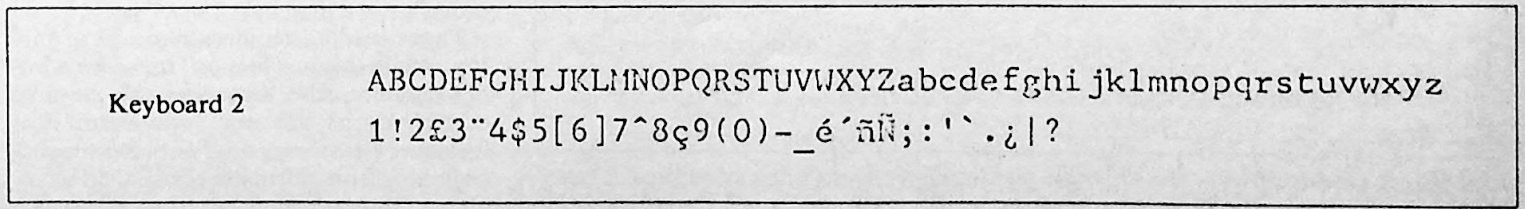
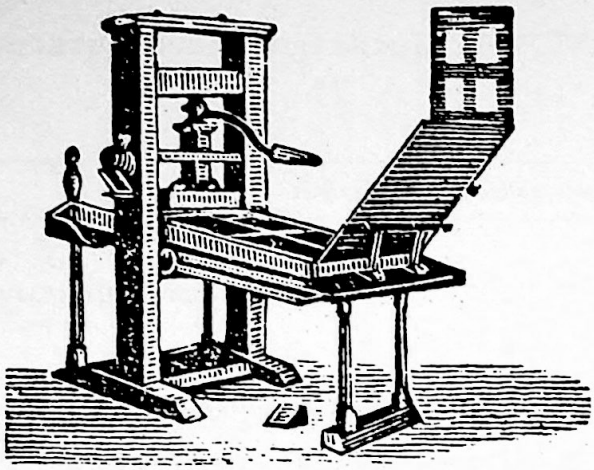


Figure 2. Complete character sets available from keyboard.





Re: Print

David Lubar

Printers. They haunt me at night, chasing me on tractor rollers, trying to snare me with lassos of ribbon, shouting "Review me!" There are so many new ones. But it isn't all a horror show. A good printer is a thing of beauty, worth using, worth reviewing. Two front runners caught up with me this month. Their stories follow.

Cost Effective

The Olympia 100KRO is a printer to ponder. Doubling as an office typewriter, producing letter-quality printout with a daisy wheel, it costs an unbelievably low $1690. The only tradeoff is speed. At a top speed of 300 baud, with some data required for signals and other information, the printer can do about 16 characters per second at top speed. Add to this the unidirectional nature of the printing and you don't exactly get a racing model. But at that price, who is going to complain?

While someone went on quest for a serial interface card for the Apple, I tried the Olympia as a typewriter. In some subjective way that can't be explained on paper, it just felt right. It is a large unit, with scads of extra features. One that immediately won my heart was an eight-character memory that works with the correction key. With each stroke of this key, an errant letter is removed. Great. A smart repeat key repeats whatever character was last typed. Index and reverse index keys repeat automatically when held, advancing or retreating the paper. The wide carriage with friction feed takes anything fed to it, and a control switch allows for carbon copies. Margins, once set, are remembered for up to 90 hours with the power off. Any changes in settings are reinforced with a beep, letting you know the Olympia has heard you. Taking the Olympia beyond the smart-typewriter class, a serial port in the rear of the machine allows communication with any computer capable of serial communication.

Once an interface card appeared, the real test began. First, the Olympia produced a mixed-case file from Apple Writer. The next test was short program listing. Everything seemed fine until I took a close look at the listing. The greater-than and less-than signs had been replaced with other symbols. An examination of the type wheel confirmed the absence of these characters. Fortunately, a call to Olympia produced the hoped-for answer. An ASCII wheel is available, but it was currently on back order. Although this prevented a test of the ASCII wheel for now, Olympia seems determined to grab a share of the computer market, and the scarcity should be short lived. Beyond this small problem, all was fine (see Figure 1 for print samples). With a California Computer Systems serial interface, the user just plugs in both ends of a serial cable (not supplied), and the printer is ready to run. Some interfaces require a special wiring jumper. Again, Olympia provided the required information, showing evidence of good customer support.

The printer is accompanied by a manual that covers the typewriter aspect, and a few spec sheets on the interface which might bring joy to the hearts of engineers but did little for me. Fortunately, the specs aren't needed unless one wishes to create some sort of special interface or other bizarre project.

Ribbons come in cartridge form, with carbon and fabric being available, and they just snap right in. A separate spool holds the correction ribbon. Type wheels snap in using a special holder. If you need letter-quality printout and can live with a slow print speed, the Olympia 100KRO is definitely worth checking out.

Olympia is backed by a large dealer network, and many stationery stores carry Olympia supplies. Since it existed as a typewriter before the introduction of the interface, the scarcity of supplies that plagues many printers shouldn't be a problem. If you plan to use it for program listings, make sure an ASCII wheel is available from your dealer. If your main application is word processing, it's ready to go as is. Just add a serial cable and an interface if your computer doesn't have one, then let the beauty loose.

The Olympia 100KRO lists for $1690. Their address is Olympia USA, Inc., Box 22, Somerville, NJ 08876.

CIRCLE 317 ON READER SERVICE CARD

Connect the Dots

Rising from the ashes of the 737, the Centronics 739-1 is a dot matrix printer with some nice features. It takes fanfold, roll, or single sheet paper, prints at up to 100 characters per second, uses a parallel interface, and has switch-selectable character sets for six languages. The baud rate is also switch selectable, and can range from 50 to 19200. We tested it on a TRS-80, but it should work on any system capable of parallel communication.

Let's get the few negative aspects out of the way first. The design of the paper feed is such that fanfold paper, if left unattended, will curl back to the rear as it emerges and re-enter the feed area. This can cause a rather severe jam.

Paper loading requires removal of the top. While this just lifts off, it can be a bit of a nuisance. Also, some desirable printing combinations are not supported. For instance, Centronics does not recommend switching from normal monospaced char-

```
The Olympia produces letter-quality printout.  It also
functions as a typewriter.  This example was done with
a carbon ribbon and the standard typewheel.
```

Figure 1. A sample of what the Olympia has to offer.

acters to other characters in the middle of a line. This precludes such possibilities as printing a condensed superscript. Finally, while the printer produces up to 100 characters per second, it prints unidirectionally, thus losing time while the printhead returns to the left margin.

While right justification is possible using proportional spacing, it requires some complex programming on the part of the user. From one to six dot spaces can be sent using an escape sequence, but the spacing algorithm must be programmed by the user.

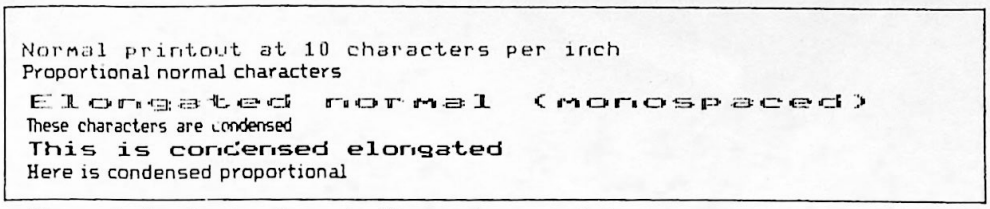

Normal printout at 10 characters per inch
Proportional normal characters
Elongated normal (monospaced)
These characters are condensed
This is condensed elongated
Here is condensed proportional

Figure 2. A selection from the Centronics cast of characters.

The above complaints are all minor, and are compensated for by nice print quality with descenders, a selection of print sizes, and graphics capability. Basically, three types of print are available: normal (ten characters per inch), condensed (16.7 cpi), and proportional. Vertical spacing is six lines per inch. Each of the three can also be printed in elongated form. Samples of these can be found in Figure 2. The 739 powers up with the normal characters. Other styles are selected through escape codes. A new code is required for each line of elongated characters. Other user controls include underlined text and half line feeds in forward and reverse directions.

Graphics are produced using codes that control six vertical pins. Once the graphics escape sequence is sent, any command to print CHR$(N), where N is in the range from 32 to 95, will produce one of 64 different vertical dot patterns. Graphics printing, with support of such codes as line feed and carriage return, continues until a new escape sequence is sent. Each line can contain up to 594 dots, producing a maximum row length of eight inches. Through user programming, a good graphics dump can be produced. Even systems without screen graphics can produce paper graphics, though the method is up to the user. With the right software driver, it would even be possible to use the graphics for special character sets. In essence, this would be a software character generator that intercepted each letter and sent the proper series of graphics commands.

In general, it seems that while the Centronics functions perfectly well without any user effort, it should be possible, with a bit of work, to get many extras from the printer. For instance, superscripts could be printed by issuing a half reverse line feed (though, as mentioned above, a condensed superscript cannot be used in a line of normal characters).

All things considered, the Centronics 739 is a worthy printer for graphics, listings, in-house letters, and any other applications that don't require fully formed characters. The printer is priced at $695 for the parallel and $795 for the serial version.

Centronics recently introduced the Model 122 dot graphics printer, which is software-compatible with the Model 739.

The Modl 122 is a 120 cps, 132-column desktop printer with standard pin-addressable graphics. It features standard alphanumeric printing and choice of 6-pin and 8-pin graphics. Suggested list price is $1195.

Centronics Data Computer Corporation is located in Hudson, NH 03051. □

CIRCLE 318 ON READER SERVICE CARD

APPLE SPEAKS INTELLIGENTLY!

The people who dared to teach Atari to talk are again challenging the microcomputer establishment with the VOICEBOX Speech Synthesizer for Apple. This low cost intelligent peripheral can speak thousands of words unassisted, generated directly from its firmware ROM dictionary located on its plug-in card. This means that speech, with variable intonation and speed, can be used in any of your apple programs without ever having to bother loading a disk. And, in case you want to expand your dictionary to include unusual words or words in foreign languages, you can easily define them with our 64 phonemes and store them by the thousands on one of the six special dictionaries provided for on our disk.

In addition your VOICEBOX for Apple can be easily coded to sing on key with uniform barlengths and you can store (record) your songs on disk, retrieving and modifying sections whenever you want. With the disk system, you'll also enjoy an educational random sentence generator and graphic speech animation! The VOICEBOX for Apple will run on 32K Apple II with Applesoft or Apple II Plus systems equipped with sixteen-sector disk drives. VOICEBOX for Apple comes with loudspeaker and disk. The Alien Group also makes a less expensive VOICEBOX for Apple with all features (including expandable disk dictionary), but excluding firmware ROM and singing capability. Speaker is optional on this unit.

For Atari users, the VOICEBOX for 16K and up Atari plugs directly into the serial port. No extra cables are needed and no speaker is needed since the speech comes directly over your TV monitor. This unit has all speech synthesis features except singing and firmware ROM.

AL-3001 VOICEBOX for Apple. With firmware ROM, singing capability and speaker $215.00
AL-3501 VOICEBOX for Apple. Without firmware ROM, singing capability and speaker $139.00
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AL-5001 VOICEBOX for Atari $169.00

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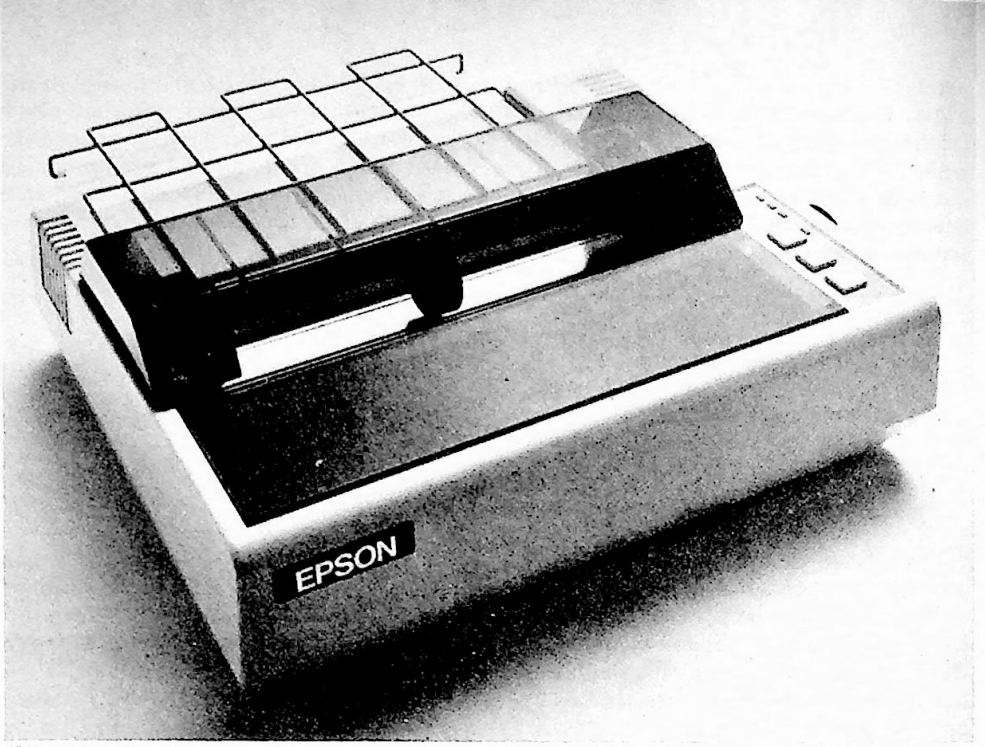
CIRCLE 103 ON READER SERVICE CARD

The Little Printer That Could

Louis A. Cuhrt



This review was written about the ubiquitous Epson MX-80. The MX-80 will soon be discontinued by Epson, but the MX-80 FT, which is the same basic printer with a platen which allows it print on regular paper (without tractor feed holes), will remain on the market. The current price for the MX-80 FT is $745.

Some dramatic developments have occurred recently in the market for printers priced under $1000. Features such as correspondence-quality print, graphics and high throughput have appeared. The Epson MX-80 incorporates these advances and carries a list price of only $645.

The unit prints 80 characters per second bidirectionally with a logic-seeking function to minimize print head travel time. The tractor mechanism is adjustable for 4" to 10" forms. The 9 x 9 dot matrix produces very sharp letters with descenders for the lower case g, j, p, q and y. By using multi-strike and/or multi-pass techniques, correspondence quality print can be produced. In addition to the complete set of TRS-80 graphic characters, special characters for French, Japanese, German and British usage can be printed. An add-on kit for use with the Apple II will provide graphics with a resolution of 120 dots per inch. (This kit should be available by the time you read this.)

Interfacing

The MX-80 comes with a Centronics-compatible parallel interface. Epson produces an interface board and cable for the Apple II and a cable for the TRS-80. I would recommend using the Epson interfaces. The firmware on Apple's own Centronics parallel board always sets the 8th data bit high. This bit is used by the MX-80 for TRS-80 graphics characters. The 8th data bit would have to be grounded on the Apple board for use with the Epson. The standard TRS-80 cable can be used, but some special features will not be available.

Louis A. Cuhrt, 4734-D La Villa Marina, Marina del Rey, CA 90291.

Character Fonts

The MX-80 has four sizes of print which are software selectable. The options are: normal width, 80 characters per line; normal width/compressed, 132 characters per line; double width, 40 characters per line; double width/compressed, 66 characters per line.

For word processing applications, there are two additional print modes. The enhanced mode, which is not available with compressed print, produces correspondence-quality print by striking each letter a second time to fill in between the dots produced on the first strike. In the double strike mode, the paper is advanced 1/216th of an inch and the line is printed again. The double strike mode can be used with all print densities and even along with the enhanced mode. Both modes reduce speed by 50 percent.

The MX-80 sets the standard for moderately priced printers.

To change print size, engage the special print modes or other paper-handling chores, all that is required is to issue a command in the form of "print chr$(14)" or "print chr$(27)+'e'" to the printer.

Other Features

The unit comes with such paper-handling features as horizontal and vertical tabs, form feed, line spacing of 1/8, 7/72 and 1/6 of an inch. An out-of-paper buzzer and a self-test mode are also included. A unique feature of the MX-80 is its disposable print head; when the head reaches its rated life of 50-100 million characters, it can be replaced by the user with a new one which costs less than $30.

Documentation

The User's Manual for the MX-80 was written by David A. Lien, the author of *TRS-80 Level I User's Manual*. It is written in the same light-hearted style as the TRS-80 manual. The manual, which is over 100 pages long, has sample programs and illustrations explaining all of the special features of the MX-80. Although the manual is written with the TRS-80 user in mind, it is equally informative for users of other computers. Separate appendices are included for users of Apple II, TRS-80 Model II, and TRS-80 Model I with the standard cable.

Noise

The unit is very quiet compared to other dot matrix printers. Friends, who own other brands of printers, have been very impressed with the low noise level of the Epson. At idle the unit makes virtually no noise.

Appearance

The Epson MX-80 is compact (14.7" x 12.0" x 4.2") and weighs only 12.1 lbs. The case is plastic and almost matches the color of my Apple II. The clear plastic top is hinged to allow access for easy paper loading, and the unit comes with a wire paper guide.

Drawbacks

With the outstanding print of the Epson, many users will want to use it for printing letters. However, the printer does not have any provison for feeding single sheets of paper. To use a sheet of letterhead, one must adjust the print head to its thickest paper setting (an easy chore), and then

FIGURE #1

```
NORMAL WIDTH (80 CHARACTERS PER LINE)
!"#$%&' ()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghij
klmnopqrstuvwxyz{|}~

NORMAL WIDTH/COMPRESSED (132 CHARACTERS PER LINE)
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~

DOUBLE WIDTH (40 CHARACTERS PER LINE)

DOUBLE WIDTH/COMPRESSED (66 CHARACTERS PER LINE)

DOUBLE STRIKE PRINTING WILL PROVIDE A MORE DENSE PRINT

ENHANCED PRINT WILL GIVE A CORRESPONDENCE QUALITY PRINT

ENHANCED PRINT WITH DOUBLE STRIKE IS EVEN MORE DENSE
!"#$%&' ()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghij
klmnopqrstuvwxyz{|}~
```

tape the letterhead to the tractor feed paper. This is not as difficult as it may sound, but it is an annoyance.

A friend mentioned that he has to be careful to avoid paper jams with his MX-80. I set-up my printer using the paper feeding pattern recommended in the User's Manual and I have not had any problems with the paper jamming or re-feeding.

There are two features that I wish had been included in the design of the printer.

1) A larger FIFO buffer. I use the printer for a hard copy of data I obtain on The Source telecomputing network. With the Epson's buffer capacity of only one line of data, a delay must be added to incoming data so the printer can keep up. This is not a problem, but it does slow things down, and connect time does cost $4.75 per hour.

2) Proportional spacing. This would be a nice feature for word processing applications.

Summary

The Epson MX-80 is an outstanding printer that has performed flawlessly during the three months I have had it. Except for some minor omissions, the printer has all the features a hobbyist or small business could want. With its outstanding print quality, low noise level and high quality construction, I think the MX-80 sets the standard for moderately priced printers. (Epson America Inc., 23844 Hawthorne Blvd., Torrance, CA 90505.) □

TRS-80 Graphics with the MX-80

The MX-80 has a built in character graphics set that is compatible with TRS-80 graphics. However, the graphics characters are displaced from normal TRS-80 graphics, ranging from CHR$(160) to CHR$(223) instead of from CHR$(128) to CHR$(191). The following program offers a screen print routine for the Radio Shack computer. The illustration is from Android Nim, published in the June 1981 issue of *Creative Computing*.

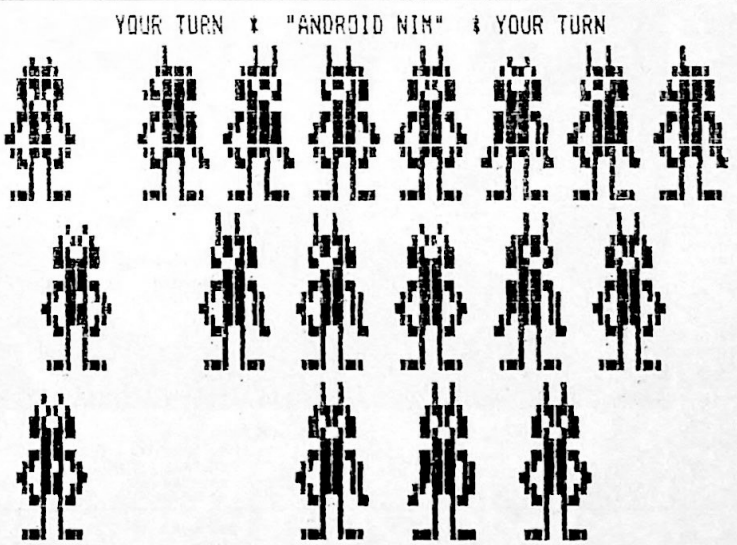
To use the print subroutine with a TRS-80 program, simply insert a subroutine call into the program at the point you desire a screen print. At *Creative Computing*, we saved the routine on diskette as an ASCII file with the command:

SAVE"SPRINT",A

and when we wish to use it in a program, we merge it with the command:

MERGE"SPRINT"

Then we insert **GOSUB 32000** at the appropriate location in the program.—*George Blank*




```
31999 REM ↕ EPSON MX-80 SCREEN PRINT SUB-ROUTINE ↕ G.BLANK ↕
32000 FOR DX=15360 TO 16383 STEP 64
32010  FOR DY=0 TO 63
32020   DZ=PEEK(DX+DY):IFDZ>127 AND DZ<192 THEN DZ=DZ+32
32030   LPRINT CHR$(DZ);
32040  NEXT DY
32050  LPRINT
32060 NEXT DX
32070 RETURN
```

The Anadex DP 9501

Gary Mellar

Selecting a printer to use with your personal computer is quite a bit different from selecting the computer itself. Most computers offer many options and peripherals that allow you to change the original configuration as your needs and finances change. Conversely, with the exception of minor options offered by some manufacturers, the configuration and features of any particular printer at the time of purchase are what they are going to be as long as you own that printer.

With these thoughts in mind, I made a list of features that I wanted in a printer. Some of these were negotiable, others were not. The features I wanted most were: acceptable correspondence quality print for letters, expanded print capablity for highlighting reports, graphics capability, full width printing, a speed of at least 100 cps and easy interfacing to my Apple II. I also wanted a piece of equipment that was reliable, since I am not the hardware type.

After I spent a considerable amount of time comparison shopping, I ordered an Anadex DP 9501 from Consumer Computers in La Mesa, CA in mid-December 1980. It was delivered via UPS in less than two weeks.

Currently Anadex manufactures two wide-carriage printers— the DP 9500 and DP 9501—and two narrow-carriage models—the DP 9000 and DP 9001. The 9000 and 9500 are very similar, except for the carriage width, as are the 9001 and 9501. The primary differences are speed and print density. However, this article will be directed at the DP 9501 only.

Printing Characteristics

There are four print densities standard on the model 9501: 10 characters per inch with an 11 x 9 dot matrix and 12.5, 15, and 16.7 cpi with a 7 x 9 dot matrix. Print head velocity is 12 inches per second yielding 120, 150, 180 and 200 characters per second respectively. All characters may be printed double width. All printing is done bidirectionally with shortest distance logic seeking. Because it is tractor fed, it can handle paper widths from 1.75 inches to 16.8 inches with a maximum print width of 13.2 inches. Thus, at 16.7 cpi up to 220 characters per line can be printed. The 9501 can print the standard 96 character ASCII set and accepts 24 control codes. For those who might be interested, there are character fonts available as extra cost options.

Features

The 9501 has many features, most of which are selectable by pre-setting dip

Gary Mellar, 11 Lincoln Dr., RD 1, Hamburg, PA 19526.

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#9667	Hodge Podge	$17.49
#9669	Teacher's Pet (Cassette)	$13.09
#9668	Teacher's Pet	$16.59

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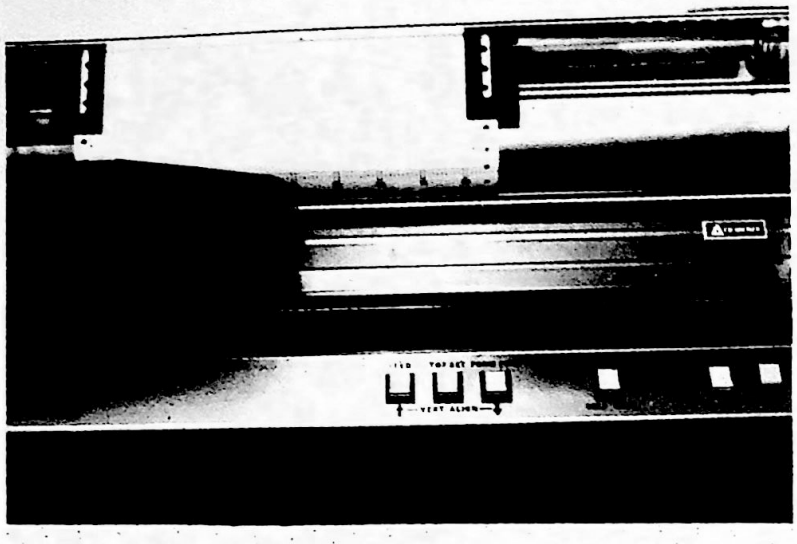
CIRCLE 142 ON READER SERVICE CARD



This is 10 Characters per inch normal and DOUBLE Width

THIS IS 12.5 C.P.I Normal Width And DOUBLE WIDTH

THIS IS 15 C.P.I. Normal Width And DOUBLE WIDTH

THIS IS 16.7 C.P.I. Normal Width And DOUBLE WIDTH

Note: g, j, p, q and y lower case letters have descenders.

Sample Print from Anadex 9501.

switches prior to power up. All are selectable via software control. In Table 1, those preceded with an asterisk are both switch and software selectable:

*10 and 16.7 cpi
12.5 and 15 cpi
*6 or 8 Lines per inch
*Top of form (front panel) switch)
Vertical tabs (up to 15)
Horizontal tabs (up to 8)
True underline
Double width printing
Graphics
Wraparound or truncate
*Auto line feed
Horizontal tabs (up to 8)
*Form feed and line feed (front panel switches)
Print width (in 10ths of an inch from 1.0 to 13.2 inches)
*Skip over perforation (1/2"—1 1/2" or 1 to 99 lines)
*Form length (1/2"—15 1/2" or 1 to 254 lines)

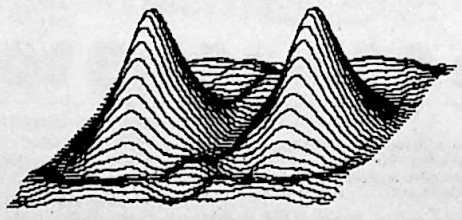
External Controls

On the rear panel are four blocks of dip switches. Two blocks of switches are used to control the features listed in Table 1. The other two blocks select the type of interface — parallel (Centronics compatible), RS-232C or 20/60 ma current loop—all of which are standard. Additionally, these two blocks set the parameters for the serial interfaces, which include baud rates (50 to 9600), word length (7 or 8 bits), 1 or 2 stop bits and parity.

Also on the back panel, is a power-type selection module which allows the user to select 100, 120, 220 or 240 volts in a frequency range of 48 to 62 hertz.

The front panel has six rocker-type switches: power on/off, paper feed, top of form set, form feed, self test and on/off line with an illuminated status indicator. The forms control switches are multifunctional; they allow bi-directional paper alignment in .014" increments.

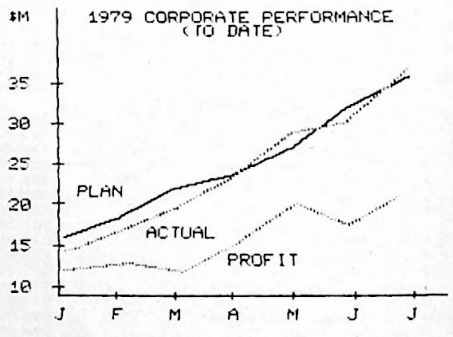
There is a print head gap adjustment lever which allows for printing of multipart forms, up to an original and five carbon copies. And, although it may seem trivial, there is one other feature that I really like: a manual paper advance knob that allows bi-directional paper registration in .056" increments while the power is on and almost infinite registration with the power off.



Graphics

As their brochure proclaims, the DP 9501 is a true high resolution graphics printer. It has a resolution of 72 x 75 dots per inch. With a print wire diameter of .014", it can completely blacken the full printable width (13.2 inches) six dots high per pass. Again all printing is done bi-directionally with shortest distance logic seeking. Of the nine wires on the print head only six are used in the graphics mode and each is individually addressable. The graphics mode uses ASCII codes from 64 to 127 decimal to select which print wires to activate for each print position. The paper can be advanced in one-dot increments, and the horizontal position of the print head can be defined in one-dot increments, which allows complete control of dot placement on the paper. This may sound very complex, but the operator's manual provides thorough documentation and two program examples (in Level II basic).

For those who wish to dump an Apple II high resolution screen to the printer, Computer Station, 12 Crossroads Plaza, Granite City, IL 62040, markets an excellent, easy-to-use machine language program with many features for the Apple II—Anadex user. Basically, any hi-res screen that can be saved to disk, can be loaded and printed with a variety of options.



When in the graphics mode, the character set is not available. The page length, top of form and form feed features are also lost and must be reset when leaving the graphics mode.

The price of $1349 includes a 2K buffer, which is especially useful in the graphics mode. It allows the computer to dump data to the printer and continue processing while the printer finishes printing. This makes more efficient use of the system, especially if you are printing files from a disk.

As a graphics printer, the Anadex is an excellent investment.

Documentation

The 79-page operator's manual is complete, well illustrated and thorough. It covers everything one must know to use the printer; from unpacking to troubleshooting. All features are thoroughly explained. The 14-page section on graphics includes two sample programs that cover the complete use of the graphics mode.

Also provided is a handy reference card with communication control codes on one side and the configuration control switch assignments on the other.

Summary

The Anadex DP 9501 is an exceptional printer at a reasonable price. It has all the features that I wanted most, many that were negotiable and one or two that were not even on my list.

I believe that I have covered all of the features on my most wanted list except the quality of the print. Although it is not a fully formed character type printer, the 11 x 9 dot matrix pattern at 10 cpi closely resembles the traditional type size of most typewriters and has been quite satisfactory for all my personal and professional correspondence.

Up to this point I have deliberately omitted any reference to service and support by Anadex. I thought that I would save the dessert for last.

After using the printer for about two hours, it stopped printing; the print head continued to move just as though nothing were wrong, but no printing occured. The troubleshooting manual described these symptoms exactly—faulty circuit board or print head or both. Needless to say, I had a sinking feeling in the pit of my stomach. Although it was already past normal business hours on the West Coast, I thought I would try to reach Joe King at Anadex anyhow.

The Anadex DP 9501 is an exceptional printer at a reasonable price.

I had several very informative conversations with Joe prior to my purchase of the Anadex. He had given me a lot of technical information on both the DP 9500 and DP 9501 when I was trying to make a decision on a printer. It was these conversations that finally convinced me to purchase an Anadex. It is refreshing to find a manufacturer who is more than willing to help an end user or potential end user. Joe has assured me that Anadex is committed to support their users.

So, I made the phone call and sure enough I reached Joe King. He determined that my problem was the print head fuse and advised that if, after replacing it, it failed again, I contact the local service center in Rockville, MD for replacement of the circuit board or print head or both. It turned out to be only a bad fuse, but I called the service center anyhow to establish contact with them. They reassured me that in the event of any failures in the unit they would replace any or all parts on a walk-in-walk-out basis, which was very comforting.

In late February, the plastic window on the ribbon cartridge cracked and began leaving a slight smear on the paper. Another call to Anadex resolved this problem; a new ribbon cartridge arrived two days later via UPS Blue label.

What more can I say, except that I am exceptionally happy with the printer and the service. Anadex stands behind their product and is committed to satisfying their users. □

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CIRCLE 148 ON READER SERVICE CARD

The Nearly Perfect Printer— Seeing Double

Joseph Simpson

Is there a perfect printer? In the July 1981 *Creative Computing*, George Blank listed a set of requirements for his ideal printer. They paralleled my own.

The Epson sure looked attractive and still does, but with all the activity in the printer market I decided to wait a while. After all I waited three years for the perfect pocket calculator. No matter that it broke four years later and the model has been discontinued.

Recently, I found a fast, flexible, dot matrix printer with a reasonably attractive character set, dot graphics, buffer, and friction/tractor feed. It even looked pretty. At a suggested retail price of $795 it was time to buy.

Actually, I had found a pair of printers. The basic mechanism is manufactured by TEC and marketed by NEC and C.Itoh. There are strong similarities, and a few differences between the printers.

Design

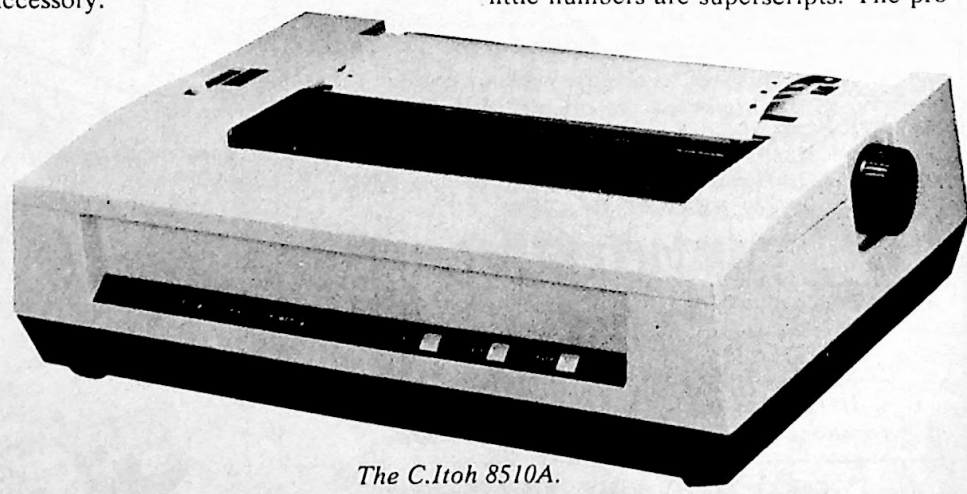
The physical design of these printers makes setup and operation easy. Configuration switches are easily reached with screwdriver or steak knife without removing the cover. With 16 switches to play with, there are many options, ranging from selection of European character sets to a slash through the zero. I particularly appreciate an accessible printer cable connector.

Single sheet and roll paper are fed typewriter style. The tractors are hidden below a plastic cover. To mount tractor forms, the cover is removed, paper mounted, and the cover replaced. The cover does a fair job of preventing paper jams, but a paper holder would be a useful accessory.

The tractors handle one-up gummed labels through 8 1/2 inch plus tractor hole paper (3-7/8" to 9" between tractor holes). The paper out switch works with continuous and single sheet paper. A model with a 15" wide carriage has been developed and should be available by the time you read this.

Character Print Options

Figure 1 illustrates the character set and many of the special features provided by this pair of printers. Yes, those funny little numbers are superscripts. The pro-



The C.Itoh 8510A.

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BETTER THAN EPSON ! - Okidata

Microline 82A *80/132 column, 120 CPS, 9 x 9 dot matrix, friction feed, pin feed, adjustable tractor feed (optional), handles 4 part forms up to 9.5" wide, rear & bottom feed, paper tear bar, 100% duty cycle/200,000,000 character print head, bi-directional/logic seeking,* ***both serial & parallel interfaces included****, front panel switch & program control of 10 different form lengths, uses inexpensive spool type ribbons, double width & condensed characters, true lower case descenders & graphics*
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MSM-104000 ..... $234.95 ea 2 for **$224.95 ea**

Shugart SA455 *half-size double-sided 48 TPI*
MSM-104550 ..... $349.95 ea 2 for **$329.95 ea**

Shugart SA465 *half-size doule-sided 96 TPI*
MSM-104650 ..... $399.95 ea 2 for **$379.95 ea**

Tandon TM100-2 *double-sided double-density 48 TPI*
MSM-551002 ..... $294.95 ea 2 for **$269.95 ea**

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MSM-104500 ..... $349.95 ea 2 for **$329.95 ea**

Tandon TM100-3 *single-sided double-density 96 TPI*
MSM-551003 ..... $294.95 ea 2 for **$269.95 ea**

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MSM-155300 ..... $369.95 ea 2 for **$359.95 ea**

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Tandon TM848-1 *single-sided double-den thin-line*
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Figure 1.

Character Sets

123 123 123 123 123 123 123 123 123 123 123 123

Standard Pitches

5 CPI
12345

6 CPI
123456

8.5 CPI
123456789

10 CPI(PICA)
1234567890

12 CPI(ELITE)
123456789012

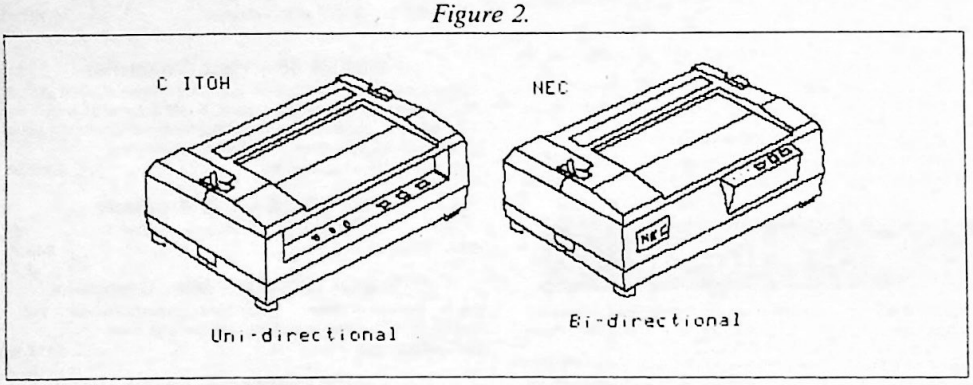
17 CPI
12345678901234567

This line was printed in proportional mode.

Fonts

Normal Font Bold font gqy Underline Font gqy

Figure 2.



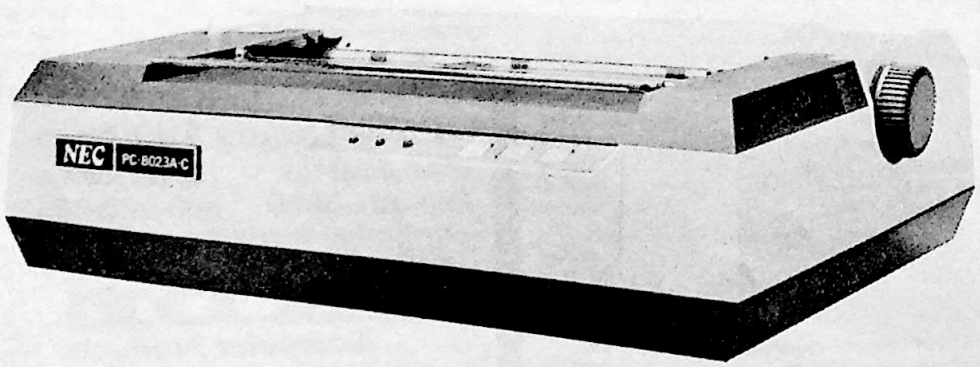
portional mode would be great if word processing software were available to support it.

Combinations of print enhancements are legal, e.g. underlined, boldface, double width characters can be printed. You can print in the normal (down the page) direction, or in reverse (up the page). Line spacing can be varied from 1/144" to 99/144".

A sophisticated vertical forms unit provides easy forms handling for business purposes. I avoid printing near paper perforations by providing for an automatic six-line skip after 60 lines have been printed. Horizonal tab stops are easily set and removed.

Speed

Speed is one of the attractive features of these printers. Set to normal pica characters, the NEC prints at 100 characters per second and the C.Itoh at 120 cps. The speed penalty for bold face print is approximately 25 percent. Bi-directional printing and heavy duty construction account for much of the speed. Each printer weighs twenty pounds.



The NEC 8023A.

A buffer influences effective print speed. I dump a screen of 800 characters in two seconds. Then, while the buffer contents are being printed, I proceed to the next step in my program. Of course, if your burst print requirements exceed buffer size this feature is less useful.

The NEC has a standard 2K buffer. The C.Itoh is supplied with a 1K buffer in the parallel version and a 3K buffer in the serial version. The 1K buffer can be expanded to 3K by plugging in two 2016-2 RAM chips, a chore best left to your dealer.

Documentation

The documentation is quite good. Setup and normal operation are well covered with text and pictures. Use of special features requires minimal programming experience, or at least the ability to manipulate the ASCII character set.

The NEC documentation is written for NEC personal computer NBasic, but is easily translated. The C.Itoh documentation is context free. Its clear organization, 8 1/2" by 11" format, and copious examples make it a pleasure to use.

Graphics

The dot graphics capacity of these printers is impressive. Resolution is approximately 82 dots per inch vertically and from 80 to 160 dots per inch horizontally. Bi-directional graphics print speed was a pleasant surprise.

The problem with bi-directional graphics print is that dots are shifted one dot space left or right with each pass of the print head producing rippled vertical lines. Pictures of dollar bills look great, but graphs and charts do not.

The C.Itoh in unidirectional mode prints graphs as well as any printer I have used. The NEC does not support unidirectional print. Figure 2 is a worst case illustration of the bi-directional print registration problem. The NEC picture was printed in bi-directional mode because of the speed.

Service

Service is also important to me. Remember my calculator? Local, reliable service is one reason for my patronage of a local computer store. NEC handles service at the wholesale distributor level, which is local enough for me. Modular level service will probably be offered at the retail level.

As I write, C.Itoh printers must be returned to Leading Edge Products in Massachusetts. Leading Edge is now developing a nationwide service network. I anticipate taking my printer to the store at which it was purchased for service. An owner can replace the print head without tools.

Trade-offs

I struggle to find fault with these printers. They are a bit noisier than the Epson but quieter than the IDS Paper Tiger series. Since my printer is in my home, I do wish it were a bit quieter. The C.Itoh is noisier than the NEC. Is that the price I pay for the extra 20 cps?

These printers are so new that little applications software has been developed for them, graphics dump and printer interface software being the exceptions. Special features are usually controlled by escape sequences, which are generally composed of visible ASCII characters. The sequence ESC(005,013. sets tabs at columns 5 and 13. The visible sequence simplifies inclusion in user programs. A control code approach would result in shorter sequences which may be important in some applications such as *Wordstar* setup.

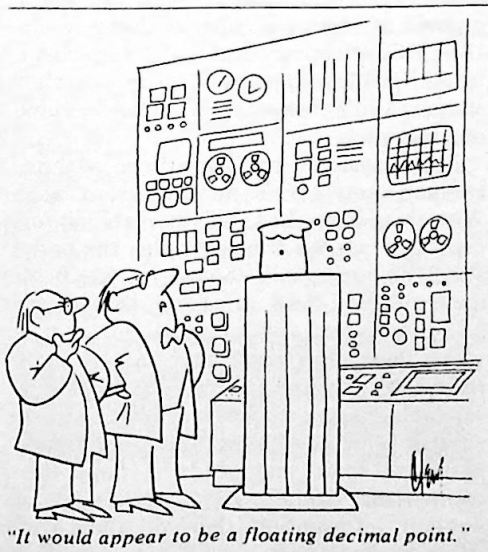
As shown in Figure 1, character descenders touch the underline. Superscript numerals and special characters have ASCII equivalents different from the corresponding normal characters. On the other hand, they do exist along with Greek and mathematical symbols.

Differences

Although these printers are very similar, a few differences may influence your choice. The C.Itoh produces better graphics. The NEC is a bit quieter, probably because it is also a bit slower. If graphics are not important, local support and service are good selection criteria.

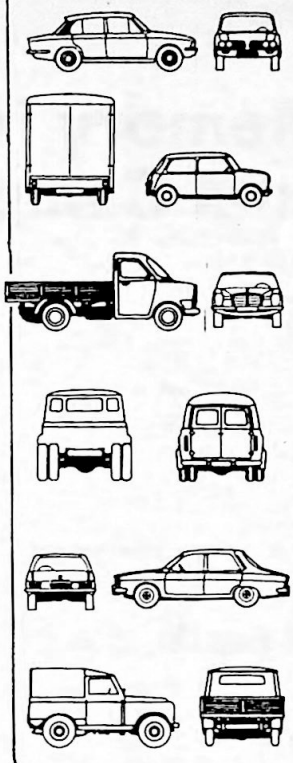
Conclusion

Competition in the medium price/performance printer market is a buyer's dream. Check out the print appearance, serviceability, and operation of the half dozen or so printers in this category before you buy. Each has its distinct advantages. With so many models from which to choose, even the chronically critical should be satisfied. □



"It would appear to be a floating decimal point."

GRIDLOCK



Recently a malfunction of traffic lights in midtown Manhattan created a classic case of gridlock on several one-way streets and avenues. In other words, vehicles entered intersections without being able to get across thus blocking traffic in other directions.

Dodgem is a game based on a gridlock. In the game, two players try to maneuver from three to eight vehicles across an intersection, one south to north, the other west to east. Each player attempts to keep his lanes open while blocking his opponent.

Sound easy? It's not. **Dodgem** can be played against the computer or a human opponent.

Dodgem is one of nine games in the **Apple Games Pac**, a collection of strategy and action games. Other games on the disk include **Nuclear Reaction** (a challenging high-tech version of Roman checkers), **Brickout** (knock down a wall—four skill levels), **Blockade** (two players each build a trail of walls), **Torpedo Alley** (destroy enemy ships with torpedoes from your submarine), **StarWars** (zap the TIE fighters—a joystick helps!), **Rocket Pilot** (land in rough terrain), **Saucer Invasion** (your SAM missiles against the devious saucers) and **Genius** (a fast-paced, timed trivia quiz).

Disk CS-4507 is $19.95. Requires 32K Apple, disk, DOS 3.3 and paddles and/or joystick. To order send payment plus $2.00 postage and handling to Creative Computing, Dept. C826, 39 E. Hanover Avenue, Morris Plains, NJ 07950. Orders may be charged to your Visa, Mastercard or American Express account — by mail include credit card name, number and expiration date, or use our toll-free number, 800-631-8112. In NJ only 201-540-0445. NJ residents add 5% tax.

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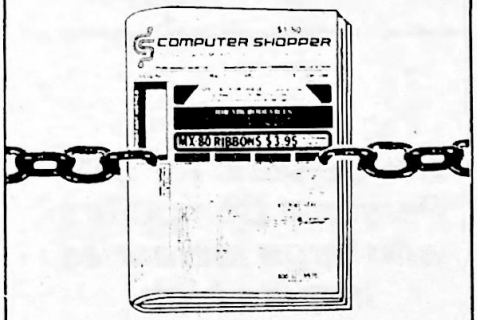
YOU'VE JUST FOUND THE

MISSING LINK!



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Expansion Memory for the IBM Personal Computer

Will Fastie

There is a phenomenon in marketing called the "after market." It is a very simple concept. It means that as a result of a new product introduction, a new market opportunity arises for other products related to the newly introduced one. The very small computer system market has an extraordinarily large after market by many measures; the introduction of the IBM Personal Computer expanded it considerably.

Many people thought that software vendors would respond with lightning speed to the IBM PC, but software is coming more slowly than expected. The hardware market, however, is booming, and in at least one area it is explosive. That area is the market for add-in memory.

What Is Add-In Memory?

The processor in the IBM Personal Computer is the Intel 8088. This computer is capable of addressing about one million bytes, or characters, of "main" memory. Normally, however, the system is purchased with 64 kilobytes (a kilobyte is 1024 bytes, and is usually abbreviated K) or less.

IBM designed the system to accommodate a maximum of 64K bytes on the main system board, and offers options which can be plugged into the computer to extend the memory available. These options are referred to as "add-in memory" because the additional memory is not an integral part of the system board.

Add-in memory may be an important option to consider depending upon the software the computer is to use. Some programs absolutely require more than the basic 64K of memory, while others allow greater flexibility, functionality, or data capacity if extra memory is available. Some examples are the IBM Fortran language compiler, which requires more than 64K before it will even execute; and VisiCalc, which runs in 64K but which can process larger models in bigger memories.

The demand for IBM Personal Computers with large memories is quite high.

So Why The Explosive Market?

It turns out that the demand for IBM Personal Computers with larger memories is quite high. And, given the state of memory technology, so is the price of the IBM add-in memory. Those two factors combine to create a very dynamic, cut-throat market.

At the time of this writing, about 30 companies supply add-in memory products for the IBM. With prices as much as $400 less than equivalent IBM options, and with capacities as much as eight times the largest IBM board, these companies are fighting for their piece of the pie.

It is the state of the technology which has really made this possible. IBM, both on the system board and on the option boards, uses 16K RAM (random access memory) chips. These chips hold 16K bits of information, so eight chips are needed to form a 16K *byte* bank. Also, because the IBM machine supports a technique known as parity checking which can detect a failing chip, one additional 16K chip per 16K byte bank is required. So a 64KB (kilobyte) memory requires 36 chips.

However, the after market competition is *not* using these chips. Instead, manufacturers are using the newest memory chips available, with capacities of 64K bits per chip. With these, it is possible to build a bank of 64KB with only nine chips, and the reduction in number of parts means less space required on a circuit board, simpler construction, and higher reliability. Better yet, these chips allow 256KB of memory to be placed in the same space previously occupied by only 64KB!

The two boards IBM offers to expand memory are 32KB and 64KB, and both use the 16K chips. That, and the small number of expansion slots available in the IBM PC, effectively limits the expansion to 192KB. Most systems will have a display adapter and a disk adapter, which occupy one slot each.

Many systems will also have a third adapter, usually the communications card. With three slots used, only two are left for memory; two 64KB boards plus the basic 64KB on the system board is 192KB of main memory. And, of course, that leaves no room to add anything else.

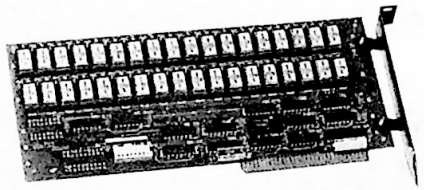
All these facts must have run through the minds of many people. The result is a veritable torrent of memory boards from sources other than IBM, and a marketing battle of some magnitude. I hope this comparison will provide you with a weapon, information, that will allow you

W. H. Fastie, 7110 Sheffield Road, Baltimore, MD 21212. Correspondence can only be acknowledged when a stamped, self-addressed envelope has been provided.

The Microsoft RAMCard did, in fact, have a bad chip. However, I ignore the failure because Microsoft was the last vendor I learned of before I began to write and the board was shipped to me in great haste. When I called Microsoft about it, they stated that they test all memory boards before they leave the plant, so I think somebody pulled one off the line early, or populated the board with chips and sent it to me without testing.

The Installation

Installing one of the memory cards is generally simple. First, the switches on the system board must be set to reflect the new total amount of memory installed (see box). This is explained in the IBM Guide to Operations, but most of the boards included these instructions as well.



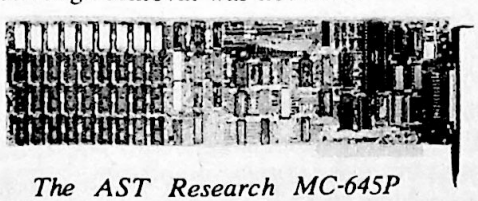
The Datamac DM-256.

Next, a set of switches must be set on the memory board itself. This setting is the address of the memory segment contained on the board. All of the boards were factory set for installation at address 10000 hex, which is just after the memory on the system board. Most boards allowed settings to any 64K boundary in the memory space, but a few were fixed at address 10000, including the Intermedia 4192 and the Micro Match MM64.

Micro Match indicates in their instruction booklet that any 64K boundary can be specified at the time the board is ordered. The Sigma Designs SD64 can be set for any 64K boundary, but the adjustment requires soldering, something I don't consider very user-friendly.

Each board was a little different as far as the switches were concerned, so I can't describe how they should be set. The Macrolink board, however, has a unique rotary switch, which I consider the easiest to understand and use.

Finally, the board is physically inserted into any slot in the IBM PC chassis. I expected this to be uniformly simple, but I had a bit of difficulty with several boards. I found the AST Research Combo card moderately difficult to insert, and equally difficult to remove. Both Chrislin Industries boards were difficult to insert, although removal was not hard.



The AST Research MC-645P

How to Set the IBM Personal Computer System Board Switches

The IBM Guide to Operations does a very good job explaining how to set the switches for the various amounts of memory that can be installed in the system. However, the explanation stops at 256KB, the amount of memory IBM has announced for the PC. Here is a chart of all the switch settings, in 32KB increments, up to 544KB, the maximum supported by the switches.

The switches of interest are positions 3 and 4 on Switch 1 and positions 1 through 4 on Switch 2. (Consult your Guide to Operations for the locations of these switches.) For memory capacities of 16KB to 64KB, positions 1 through 4 of Switch 2 are always set to ON. Positions 3 and 4 of Switch 1 are set as follows:

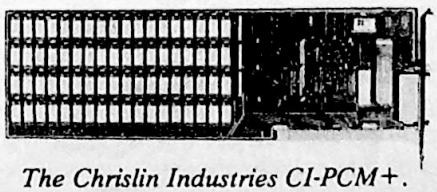
Memory Size	Position 3	Position 4
16KB	ON	ON
32KB	OFF	ON
48KB	ON	OFF
64KB	OFF	OFF

Beyond 64KB, positions 3 and 4 of Switch 1 are always set to OFF and Switch 2 is set as follows:

	Positions				Number of
Memory Size	1	2	3	4	32KB Increments
96KB	OFF	ON	ON	ON	1
128KB	ON	OFF	ON	ON	2
160KB	OFF	OFF	ON	ON	3
192KB	ON	ON	OFF	ON	4
224KB	OFF	ON	OFF	ON	5
256KB	ON	OFF	OFF	ON	6
288KB	OFF	OFF	OFF	ON	7
320KB	ON	ON	ON	OFF	8
352KB	OFF	ON	ON	OFF	9
384KB	ON	OFF	ON	OFF	10
412KB	OFF	OFF	ON	OFF	11
448KB	ON	ON	OFF	OFF	12
480KB	OFF	ON	OFF	OFF	13
512KB	ON	OFF	OFF	OFF	14
544KB	OFF	OFF	OFF	OFF	15

Readers with a technical orientation will notice that the switch settings represent the number of 32KB increments installed above the 64KB of memory on the system board. This number can be derived by considering the switches a binary number. Read from right to left, and let ON represent zero and OFF represent one.

The boards were different sizes and shapes, within the constraints of the PO design. The majority of the boards tested were full length, which means that they extended from one end of the chassis to the other. All such boards came with a slot guide, which supported the end of the card nearest the front of the chassis.



The Chrislin Industries CI-PCM+.

The Bitstream BTS2.

All the boards came with the proper mounting bracket for the rear of the chassis except for the Bitstream BTS2. I consider the BTS2 only marginally acceptable as a result, because even with the provided slot guide the board wobbles. The Intermedia board has a foot which rests on the bottom of the cabinet in the front, providing an extra degree of

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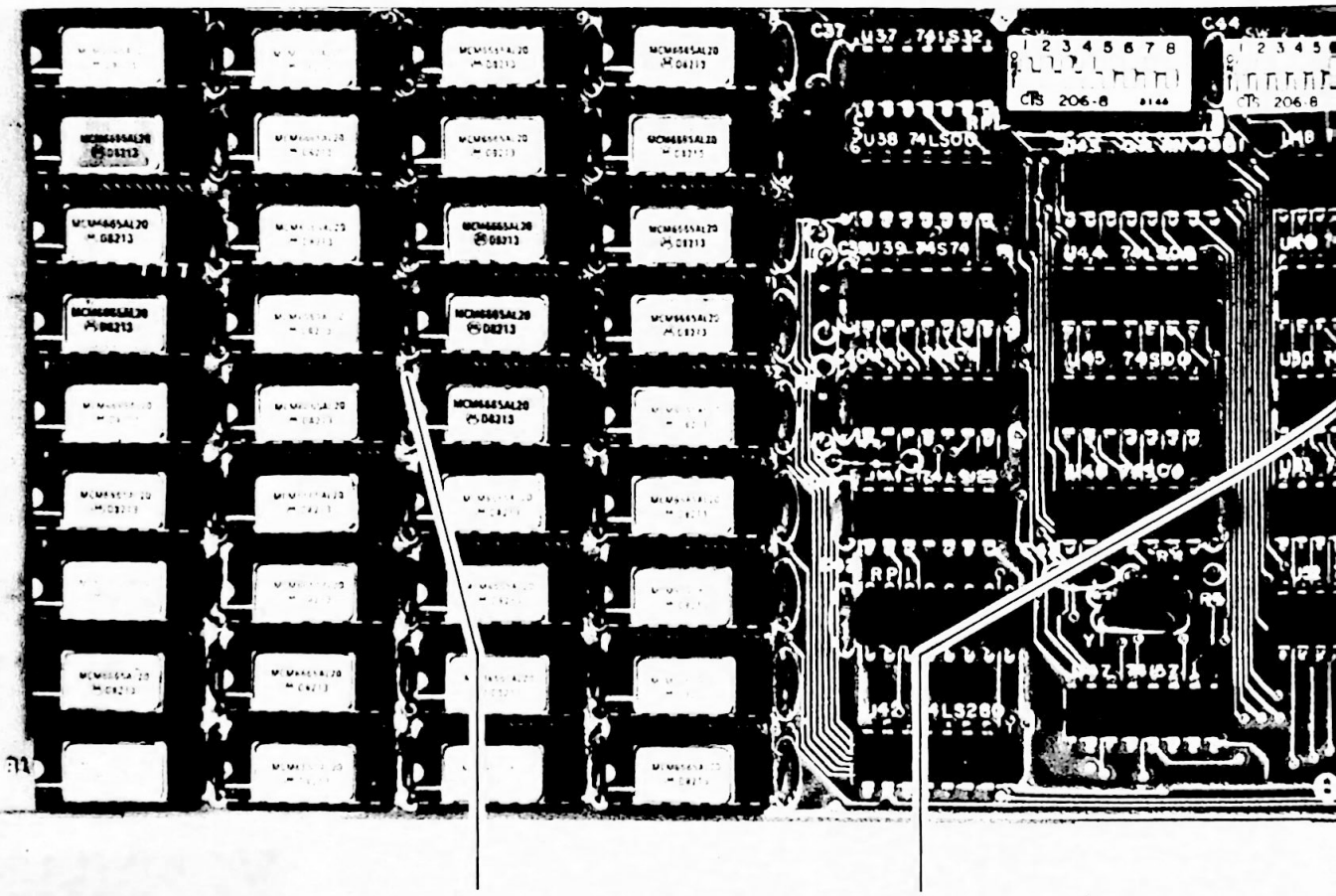


ACTUAL SIZE

PROVEN DESIGN.
Quadram has been shipping IBM boards with each of the Quadboard functions on separate boards since December, 1981. They are still available as separates (including a Dual Port Async Board) for those who desire a quality board but do not need to keep slots open for future expansion. And they all come with a one year warranty from the leader in technology applications.

256K MEMORY EXPANSION.
Socketed and expandable in 64K increments to 256K, full parity generation and checking are standard. A Quadboard exclusive feature allows parity to be switch disabled to avoid lock-up upon error detection. The dip switches also allow it to be addressed starting on any 64K block so that it takes up only as much as it has memory installed. Memory access and cycle time naturally meet all IBM specifications.

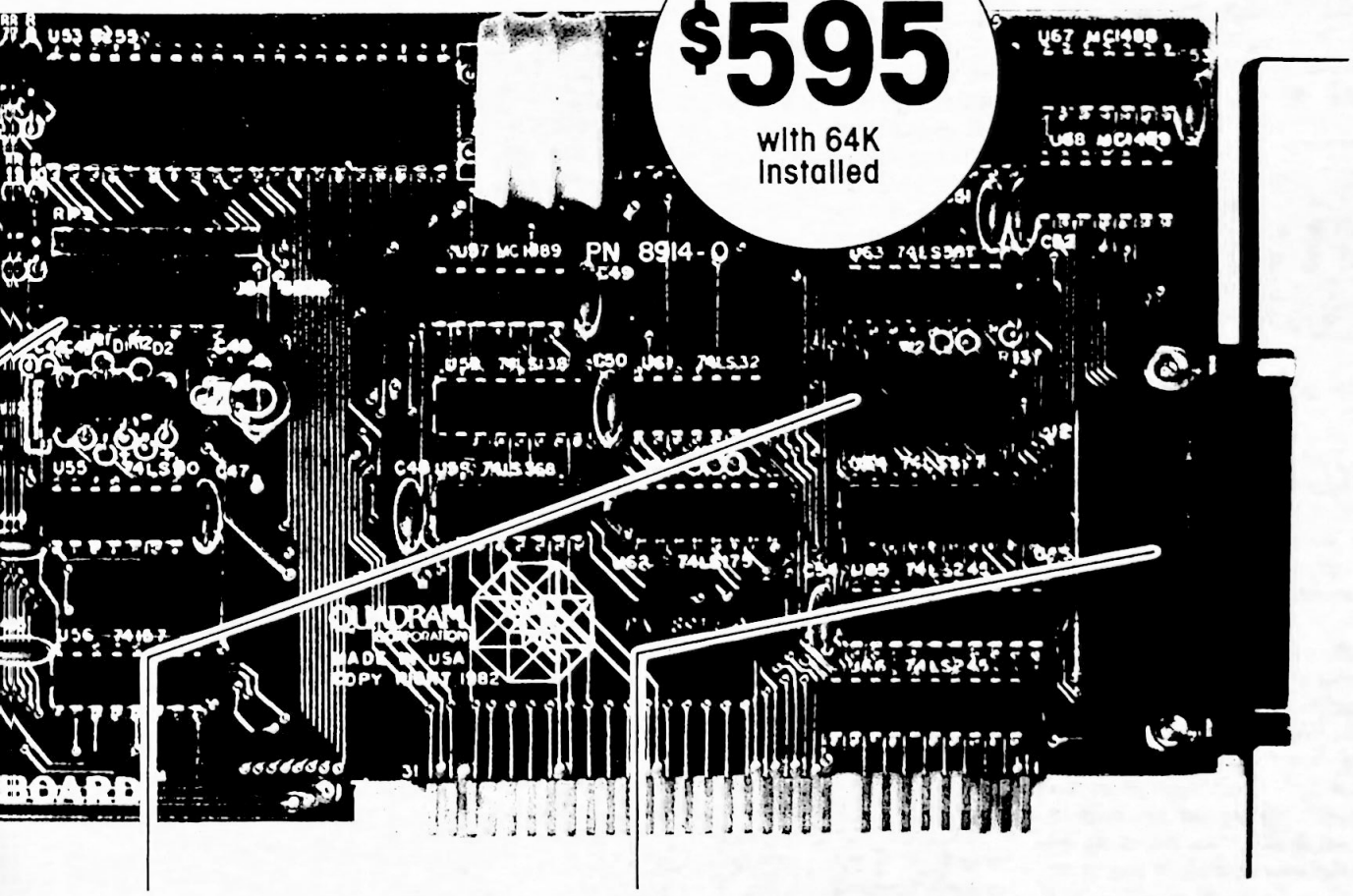
CLOCK/CALENDAR.
Quadboard eliminates the hassle of manually inputting the date on system boot-up by providing for the clock and all software routines necessary for inserting the appropriate programs on your diskettes. The internal computer clock is automatically set for compatibility with most software routines which utilize clock functions. On-board battery keeps the clock running when the computer is off.

BY QUADRAM

ALL ON ONE BOARD
Now you can utilize all the PC's capacity with Quadram's extremely flexible configurations. And it's totally compatible with IBM hardware, operating systems, and high level languages. It's a full-size board that can be inserted into any free system slot and it even includes a card edge guide for securely mounting the card in place.

INCREDIBLE PRICE!
Priced at $595 with 64K installed, $795 with 128K, $895 with 192K and an unbelievable $995 fully populated with 256K. Quadboard! You pay less for more and still protect the few limited empty slots in your computer.

$595
with 64K
Installed



PARALLEL PRINTER I/O.
A 16 pin header on Quadboard is used for inserting a short cable containing a standard DB25 connector. The connector is then mounted in the knock-out hole located in the center of the PC backplane. The parallel port can be switch disabled or addressed as Printer 1 or 2. No conflict exists with the standard parallel port on the Monochrome board. The internal cable, connector and hardware are all included.

ASYNCHRONOUS (RS232) COMMUNICATION ADAPTER.
Using the same chip as that on the IBM ASYNC board, the device is software programmable for baud rate, character, stop, and parity bits. A male DB25 connector located on the back connector is identical to that on the IBM Async Adapter. The adapter is used for connecting modems, printers (many letter quality printers require RS232), and other serial devices. Switches allow the port to be configured as COM1 or COM2 and the board fully supports IBM Communications Software.

AVAILABLE NOW!
Quadram does not advertise products until shipments have begun. Count on it. But order today for immediate delivery.

ASK YOUR DEALER.
All products are sold through local personal computer dealers. If yours does not stock Quadram, please ask him to call us at (404) 923-6666.

QUADRAM CORPORATION

4357 Park Drive/Norcross, Ga. 30093

CIRCLE 176 ON READER SERVICE CARD

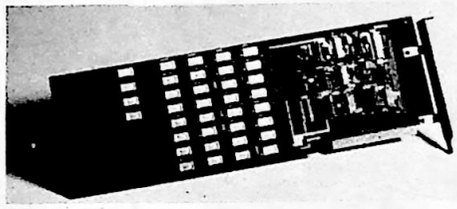
stability; it was the only board so equipped.

The Instructions

My quest to get some clue about the attitude of the vendor toward quality led me to examine the packaging, the physical appearance of the board, and the documentation. I considered the documentation to be the clearest indicator, with the packaging a distant second and the looks of the board last. I read all the documents very carefully.

There were no winners in the board appearance category. The problem is that some of the boards looked ugly but appeared to have been designed well. Some of the boards did not have a solder mask, which tends to make them look less attractive but has nothing to do with their quality.

There were certainly winners in the packaging contest. Microsoft came in first, with a really nice looking package and good shipping and static protection. Xedex came in second, with nice everything; even their outer shipping boxes carry their logo, looking very much like IBM boxes (hmmm).



The Micro Match MM64-4.

Everybody else came in third except Micro Match. They all had acceptable shipping boxes which were compact and in which the boards fit perfectly, and most had acceptable static protection. Micro Match sent a huge box full of "peanuts," those little pieces of styrofoam, and they were full of static. The board was wrapped in plastic, though.

I rate the documentation for almost all the boards "excellent" and "clear." Daystar, Bitstream, Macrolink, and AST Research get a "clear," but rate only an "okay" otherwise. In general, my complaint is that it took me longer to understand the instructions, but in all cases I was able to get the information.

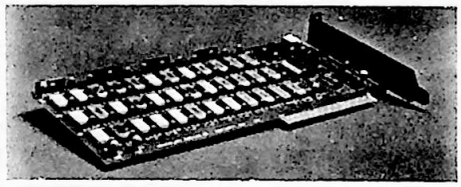
The Tecmar PC-Mate.

I rated Davong and TecMar "okay" but "unclear" because in both cases I became confused about switch settings, and serious concentration was required before I was able to understand.

Finally, I rated Intermedia "none." No documentation is supplied with this board, although the two simple instructions needed are printed on the board itself! I can't fault them, but I think one sheet which shouts "This is really simple!" would have been a little better, especially since the consumer in this case probably expects some paper.

The winners for documentation are Microsoft, Micro Match, and Chrislin.

The winners for documentation are Microsoft, Micro Match, and Chrislin, because each provides *schematics*, which I consider to be very important in general and essential if the board is purchased through the mail. Microsoft's document was the best produced overall, although it had some errors. The Personal Systems Technology document was also excellent, and matched the style of the IBM documentation precisely; in fact, it was a little better. It was designed to fit in the Guide to Operations, like the instructions that come with IBM products.



The Personal Systems PC256.

In terms of the good feeling I got from these considerations, I rate Microsoft first, Macrolink second, and Chrislin third. It's not that these vendors are extraordinarily better than the rest of the pack, but they can be clearly distinguished for one reason or another.

The Extras

Some of the boards I tested are more than plain memory boards. Some of them have additional functions which have nothing to do with memory at all.

The most common addition to memory boards is a serial asynchronous RS-232 communications adapter. This interface is needed to communicate with the outside world, that is, other computers, and is often used to connect computers to daisy-wheel printers. Part of the irritation with the IBM version of this interface is that it is a very small, simple board, but it occupies a full expansion slot.

Adding it to the memory board means that you can combine two functions into a single slot, thus saving a slot for something else. Also, the incremental cost of the serial port on the memory board is usually less than the cost of an independent adapter.

The second most popular extra seems to be a parallel printer port, like the one needed to connect the IBM printer. Combining the printer interface with memory is particularly useful for systems having only the Color/Graphics adapter, since unlike the Monochrome adapter it does not have an integral printer port.

Three of the boards tested had a serial port. They were the AST Research Combo, which also includes a printer port, the Chrislin CI-PCM+, and the Sigma Designs SD1256+. All have a connector mounted through the rear mounting bracket, and the AST Research Combo has an additional cable to bring the printer connector out through the extra cut-out in the back of the PC. All of the interfaces worked properly.

The serial ports were tested online to my Hayes Smartmoden and The Source, and the AST printer port was checked against my IBM printer. The only criticism is of the Sigma Designs board, because again, like its little brother the SD64, the SD1256+ requires soldering to change the I/O address of the serial port.

Another thing I will categorize as "extra" is the presence of more than 256KB on a single board. I tested two such boards, the Chrislin CI-PCM+ (that + seems to mean a lot!) and the Daystar UltraRam, both of which can be configured with up to 512KB of memory. The boards I tested were both fully loaded, and both worked properly.

The Daystar Systems UltraRam.

The IBM PC is not, however, equipped to deal with memory beyond 512KB, and the addition of these boards gives a total memory size of 576KB. There is some confusion about memory size in the software; Basic, for example, claimed to have 5942 bytes free with the Chrislin board installed — a nonsense number. The Daystar manual explains how to patch the system to specify the exact memory size.

There are two other extras which deserve special explanation.

Xedex Baby Blue CPU+

The one product included in this comparison which is not really a memory board is the Xedex Baby Blue. This board is actually a Z80 CPU, a "softcard" that adds an extra processor to the system. The purpose of the Baby Blue is to allow CP/M-80 to execute on the IBM PC, and it does that quite well. To do so, it requires its own 64KB segment of memory, different from the installed memory in the PC. However, when the Z80 is not running, the memory *can* be used as extra money.

Chart 1. Add-in Memory General Information.

Company Name	Model	Tested?	Size	Capacity Min	Capacity Max	User Expansion?	Price
AST Research	MC-064SP	yes	64	64	256	yes	$ 555
	MC-064	no	64	64	256	yes	435
	MP-064	no	64	64	256	yes	395
	MC-256	no	256	64	256	yes	1,035
	MP-009	yes	64	9 Chip upgrade kit			145
Bitstream	BTS2	yes	256	64	256	yes	799
Chrislin Industries	CI-PCM	yes	256	64	256	yes	895
	CI-PCM+	yes	512	64	512	yes	1,595
Datamac	DM-064	yes	64	64	256	yes	449
	DM-192	no	192	64	256	yes	840
	DM-256	no	256	64	256	yes	1,035
	ADM-64	no	64	9 Chip upgrade kit			195
Davong Systems	DSI-EX64K	yes	64	64	256	yes	350
	DSI-64K	no	64	64	64	no	299
	DSI-256K	no	256	256	256	no	799
	DSI-K64	no	64	9 Chip upgrade kit			175
Daystar Systems	UltraRam	yes	512	128	512	yes	2,195
IBM Corporation	1501012	yes	64	64	64	no	540
	1501011	no	32	32	32	no	325
Intermedia	4192	yes	192	192	192	no	579
	4256	no	256	256	256	no	729
Macrolink	Macromemory	yes	256	64	256	yes	675
	Macromemory	no	64	64	256	yes	375
Micro Match	MM64-1	yes	64	64	256	yes	400
	MM64-4	no	256	256	256	yes	700
Microsoft Corporation	RAMCard	yes	256	64	256	yes	1,095
	RAMCard	no	64	64	256	yes	495
	RAMChip	no	64	9 Chip upgrade kit			200
Personal Systems	PC64	yes	64	64	256	yes	395
	PC256	no	256	64	256	yes	995
Sigma Designs	SD64	yes	64	64	64	no	195
	SD256	yes	256	64	256	yes	745
	SDI256+	yes	256	64	256	yes	895
TecMar	PC-Mate	yes	256	64	256	yes	1,295
Xedex	Baby Blue	yes	64	64	64	no	600

to choose the add-in memory that is appropriate to your needs.

What Is The Difference Between Memory Boards?

This is a tough question. Frankly, there just isn't that much difference between one memory board and another. They all use the same chips — maybe even from the same manufacturer.

The circuitry that interfaces the board to the computer is not difficult to understand and build, and IBM has even obliged with a description in the Personal Computer Technical Reference Manual. Most engineers would design this circuitry in about the same way. It is not unreasonable to expect different engineers to design the same board, even down to the parts used. Given all this sameness, what are the differentiating characteristics of the various boards?

There are two important ones. First, and by far the most important, is the company manufacturing the board. You can tell a great deal about the company just by looking at the box the product comes in. You can tell even more by looking at the product and its documentation. Look for *quality* and *style*. If you find them, it is likely that the product reflects the same attention.

Second, the memory circuitry does not require all of the space available on an IBM PC board. Many companies have used this fact to their advantage by adding additional functions to the board — functions which would otherwise have required the purchase of a separate adapter board. These functions include an asynchronous communications interface, a parallel printer interface, and even a clock/calendar. The special advantage of these memory boards is the additional expansion slots they save.

Why Are You Buying More Memory?

If you are thinking about additional memory for your IBM Personal Computer, you must have a reason for wanting it. Maybe you really need it: the IBM Pascal and Fortran compilers and the IBM macro-assembler certainly need more than 64KB of memory. In such a case, there is little to talk about — you must buy.

If you just *want* it, on the other hand, maybe you are trying to impress your friend or put more memory into your home computer than your company has in its mainframe. Will the new memory really help you? Will the software you have really take advantage of the additional space? And how much of the new memory space *can* the software get to? Maybe it doesn't know how to access it all. You should carefully consider these questions, and pose a few more for yourself that reflect your particular situation, before you invest in more memory.

How Much Memory Should You Buy?

The best possible rule of thumb is to buy only what you need. As you will see from the charts, buying a minimal amount can keep your cost very low. Realistically, however, you must also consider your future needs, to be sure you don't spend more than necessary later.

As far as I can tell right now, the

Chart 2. Sales and Service Information.

Company Name	Build other Memory?*	How Sold? Factory Direct?	Computerland?	Credit Cards Accepted?	Service	Warranty
AST Research	Contract	yes	some stores	yes	factory	1 year
Bitstream	no	yes	no	cash	factory	6 months
Chrislin Industries	DEC, S100	yes	yes	cash	factory	1 year
Datamac	no	—	yes			1 year
Davong Systems	Apple II	no	yes	n/a	factory	90 days
Daystar Systems	no	no	some stores	n/a	factory	90 days
IBM Corporation	IBM	yes	yes	yes	factory	1 year
Intermedia	no	yes	yes	cash	factory	1 year
Macrolink	Perkin-Elmer	yes	yes	yes	factory	2 years
Micro Match	Contract	yes	no	yes	factory	5 years
Microsoft Corporation	Apple	no	yes	n/a	factory	1 year
Personal Systems	no	yes	yes	yes	factory	1 year
Sigma Designs	no	—	—		factory	1 year
TecMar	S-100	no	yes	n/a	factory	1 year
Xedex	no	yes	yes	—	factory	90 days

*This column indicates whether the company previously manufactured add-in memory systems. The word "contract" denotes that the company has built custom memory systems.

need for additional memory is driven largely by the desire to work with larger VisiCalc models, and the requirements of software tools such as the IBM language compilers. In both cases, a total memory size of 128KB is sufficient.

For VisiCalc, an additional 64KB of memory almost quadruples the worksheet size, pounding enough space to hold all but the most complex models. For the languages, 128KB is the stated requirement, and they operate satisfactorily therein. In fact, that seems to be a magic number; of the software I have seen to date, all runs in 128KB or less. This is an effective basic memory size for the IBM PC, and it's too bad that IBM didn't provide for at least this much on the system board.

All that doesn't completely answer the question, however. There are two kinds of boards advisable: fixed-size and expandable. The fixed-size boards have a specific amount of memory beyond which they cannot expand. The IBM boards are good examples. They provide either 32KB or 64KB, and that's it. If you buy this kind of board, future memory growth requires *additional* boards. The expandable boards also have a fixed upper limit, but you can buy them in smaller configurations to begin with and later buy expansion kits, which consist of sets of chips to be added to the *same* board. The thing to remember is that the expandable board will cost more to begin with (see charts) but will become more cost-effective as it is expanded.

How Much Will You Have To Pay?

I don't know. I have made my very best effort to give prices here that are current, but the publishing lead time is such that many will have changed by the time you read this. What you can get from the prices shown, since they were collected together, is a relative indication of which companies sell cut-rate and which sell at a premium.

The Comparison

The meat of this comparative evaluation is the charts. Chart I gives general information about each board tested, including background on the company, other memory boards for the PC offered by the same company, and pricing. Chart II provides sales and service information for each company. Chart III provides my evaluation of the products tested.

The products tested are identified in Chart I. The test consisted of installing the board of the IBM Personal Computer according to the supplied instructions, setting the system board switches appropriately, turning on the system, and running the memory test from the IBM Advanced Diagnostics package.

In addition, VisiCalc, Basic, and the Volkswriter word processor were run while each board was installed to verify that each found and used the expanded memory.

When the system was turned on, I was also alert to any message from the internal power-up diagnostic. Each board has a set of switches used to set the memory address for that piece of memory, and some of the boards failed the initial diagnostic because I had set the switches incorrectly. Of course, that's good news because none of the boards were actually bad and because if you make a mistake, you can count on the PC to catch it.

I am not being completely truthful when I say that none of the boards were bad.

Chart 3. Impressions.

Company Name	Model	Quality	Packaging	Documentation	Overall
AST Research	MC-128SP	Excellent	Acceptable	Okay	Very Good
Bitstream	BTS2	Excellent	Acceptable	Okay	Very Good
Chrislin Industries	CI-PCM	Good	Acceptable	Excellent	Very Good
	CI-PCM+	Good	Acceptable	Excellent	Very Good
Datamac	DM-064	Good	Acceptable	Excellent	Very Good
Davong Systems	DSI-EX64K	Good	Acceptable	Unclear	Good
Daystar Systems	UltraRam	Excellent	Acceptable	Okay	Very Good
IBM Corporation	1501012	Good	Acceptable	Excellent	Very Good
Intermedia	4192	Good	Acceptable	None	Good
Macrolink	Macromemory	Excellent	Acceptable	Okay	Very Good
Micro Match	MM64-1	Good	Acceptable	Excellent	Very Good
Microsoft Corporation	RAMCard	Excellent	Acceptable	Excellent	Excellent
Personal Systems	PC64	Excellent	Acceptable	Excellent	Excellent
Sigma Designs	SD64	Good	Acceptable	Excellent	Good
	SD256	Good	Acceptable	Excellent	Very Good
	SD1256+	Good	Acceptable	Excellent	Good
TecMar	PC-mate	Good	Acceptable	Okay	Good
Xedex	Baby Blue	Good	Acceptable	Excellent	Very Good

I decided to include the card because at some point it is likely that Baby Blue owners will no longer use the CP/M feature. The product is really a "bridge" that allows 8-bit software to be used now, while relatively little 16-bit software exists. As the new software comes, however, more and more of the function will be performed by the native processor, and the Baby Blue will become simply an add-in memory card.

I tested this board in a slightly different manner. In addition to the tests explained above, I also combined it with another memory board. This article, in fact, was written on the Baby Blue using WordStar, with the AST Research Combo card also installed. My experiments revealed that certain combinations of boards and switch settings with the Baby Blue don't work. It is not a serious problem, but if you plan to use both the Baby Blue and a memory card, test them together at the store.

The Microsoft program CONFIG, which patches DOS, is completely automatic and easy to use.

RAMDrive!

The most exciting "extra" is the software that comes with the Microsoft RAMCard. This software can patch the operating system to allow extra memory to be treated as if it were a disk drive. The result is spectacular. To test the feature, I loaded George Eberhardt's C86 C compiler into the RAMDrive (which is referenced simply as drive C:) and executed it from there.

Invocation of the C compiler is with the command "CC" after which there is usually a delay while the program loads from diskette. With RAMDrive, the prompt appeared instantly. A side effect of the patches to the operating system seemed to be that the diskette drives speeded up. I didn't check that out with Microsoft though.

Another company, Tall Tree Systems, provides a similar software product. (They also make memory boards.) It is different enough in concept from RAMDrive that I thought some explanation was in order.

Once patched, the RAMDrive-equipped system is booted from disk. It determines the size of memory to be allocated to IBM DOS from the system board switch settings. It then examines the main memory to determine how much memory is actually in the system. Whatever is left in excess of the DOS segment is configured as an electronic disk drive.

By the way, this is the error in the Microsoft document. The book says that any setting of the system board switches is legal. This is not true. More than 64KB must be available for a RAMDrive-equipped DOS, or the system will crash with a PARITY CHECK 1 error.

A JEL (the name of the Tall Tree program) equipped system boots normally. Regardless of the switch settings, 64KB is allocated for DOS. It is necessary to run JEL once to cause the electronic disk to be initialized and to get the selected DOS memory size. JEL can also be executed with new parameters to change the default sizes, after which it causes the system to be rebooted.

The Microsoft program CONFIG, which patches DOS, is completely automatic and easy to use. The resultant DOS, however, cannot be told how much memory to use for what (other than from the system board switches, and they can't be changed conveniently). The program is well documented, works simply, and results in a somewhat inflexible DOS.

The Tall Tree program JFORMAT is hard to use and has unclear instructions. However, the result is very flexible, and can be modified with the JEL program. It also has the distinct advantage of being available separately, whereas RAMDrive is only available with the RAMCard.

I used a RAMDrive-equipped system while writing this article. I placed WordStar on C:, the electronic disk, and the response was much improved.

Board Quality

I examined each of the boards carefully to see if I could detect any manufacturing problems or flaws. I didn't expect to, but I found three. All three boards worked perfectly: I'm only calling attention to the fact that they were not built perfectly. When there is such an error, it usually must be corrected manually, a time-consuming process if it represents a design error because each board manufactured requires the correction until the original design is fixed.

The Chrislin board had a mistake in the artwork for the printed circuit board. The tracks to two of the fingers on the edge connector were connected incorrectly, and had been cut and routed to the proper fingers. In each case, the correct finger was immediately adjacent, and the correction was applied neatly.

The Davong board appeared to have two logic errors which had been corrected with wires on the back of the card. This is not an unusual technique, and many manufacturers glue the wires down. Davong did not, and the wires have just enough play that a snag might be possible if the board is handled carelessly. I was surprised to see this from Davong, because the company's President, Thomas Hong, had proudly explained to me how his firm had the resources to iterate the design quickly until it was perfect; he is affiliated with a printed circuit card manufacturer and an assembly company.

Finally, the Xedex Baby Blue had what I consider to be a correction of the worst form. A capacitor was mounted on the back of the board. I am sensitive to wires on the back, but I don't think components should ever be there. However, there is plenty of space between boards in the IBM PC, so it doesn't really cause a problem.

A Special Complaint

Of all the boards I tested, only one suffers from what I consider to be a design weakness. Ironically, it is one of the boards I happen to like, the AST Research Combo. The problem is that the capacity of the board must be set on the board by cutting tracks. This is an irrevocable procedure, and I called AST Research to ask them about it.

The uniform quality of the products is a real tribute to the state of the industry.

Their answer was that once the board had been expanded, the change was permanent, and cut tracks didn't really matter. They further pointed out that the cost of the board was reduced by the price of the switch they had not used.

I accepted that explanation until the Microsoft board failed. I was still able to test the 256KB RAMCard by setting the switches to indicate a 192KB capacity, thereby avoiding the broken chip. This is not possible on the AST board, although the system board switches could be changed to make the software think less memory was available. As for the lower price, I don't think one switch makes that much difference. Other than that, I rate the quality of the board rather high.

A Special Compliment

Time out for some subjective observations. Several of the companies and their boards impressed me very much. The strongest impression was made by Personal Systems Technology, for two reasons. First, their information packet, sent in response to my questionnaire, had been prepared very carefully. Considerable time and effort went into the response.

Further, their stationery was very tasteful (don't laugh—remember that neatness counts!), and I was impressed by the way they had taken ordinary office supplies and turned them into an attractive yet economical presentation kit.

Second, their board appears very well designed. It was the most compact board, another economy, perhaps.

The second impression came from Macrolink. In this case, the board quality caught my eye. I thought the board was well-designed, and I particularly liked the rotary switch used to select the address. Unlike the dual inline package (DIP) switches used on the other boards, the Macrolink rotary switch is easy to use, easy to understand, and represents a single switch to set.

Finally, the Microsoft RAMCard scores high in all categories, notwithstanding the error in the document and the defective chip. You have only to look at any part of the package to feel reassured by the quality.

Performance

When I wrote to the memory board manufacturers, I included a list of questions, including performance data. Once I had all the information, I quickly realized that most of it was irrelevant.

The speed of the memory chips used by most of the vendors is faster than the design of the PC allows. This means that memory speed is limited by the computer, and therefore all the boards perform the same. Many of the manufacturers simply stated the speeds of the PC as their specification.

The claimed power consumption of the boards varied somewhat. The specifications for 256KB of memory ranged from 700 to 1100 milli-amps. Daystar claimed only 700 ma maximum for their 512KB board. I couldn't draw any particular conclusions from this. For the purposes of evaluating your load, I think it is safe to say that one add-in memory board will consume about one amp.

The claims for environment also varied, but were closer than power consumption. Operating temperatures were usually in the range of from somewhere between 0 and 5 degrees C to between 55 and 60 degrees C. Humidity ranged from between 0% and 5% to about 90% non-condensing. Storage temperature could drop as low as -20 to -25 degrees C.

Conclusions

If I was going to buy a memory board now, after having tried so many, I think the choice would be difficult. For memory boards without any "extras," I think I would choose Microsoft (especially for the RAMDrive option), Personal Systems Technology, or Macrolink. For multi-function boards, I would choose the AST Research Combo board, although I would love to try the Persyst Spectrum board, which is similar. For big capacity, I think I'd go with the Chrislin Industries CI-PCM+.

This conclusion should be taken as a personal preference. All the boards tested worked perfectly. All the vendors shipped the product in acceptable packages. Almost all were satisfactorily documented. In fact, the uniform quality of the products is a real tribute to the state of the industry. You can buy these products with confidence. □

Firms Mentioned in This Article

The following firms provided boards to be tested for this article.

AST Research Inc.
17925 Sky Park Circle, Suite B
Irvine, CA 92714
(714) 540-1333

Bitstream Incorporated
P.O. Box 809
Loxahatchee, FL 33470
(305) 798-0025

Chrislin Industries, Inc.
31352 Via Colinas, No. 101
Westlake Village, CA 91362
(213) 991-2254

Datamac Computer Systems
680 Almanor Ave.
Sunnyvale, CA 94086
(408) 735-0323

Davong Systems, Inc.
1061 Terra Bella Ave.
Mountain View, CA 94043

Daystar Systems, Incorporated
10511 Church Rd., Suite A
Dallas, TX 75238
(214) 341-8136

IBM Corporation
Systems Products Division
Entry Systems
P.O. Box 1328
Boca Raton, FL 33432

Intermedia Systems
10601 S. De Anza Blvd.
Cupertino, CA 95014
(408) 996-0900

Macrolink
1150 East Stanford Ct.
Anaheim, CA 92805
(714) 634-8080

Micro Match
10343 Commerce Ave.
Tujunga, CA 91042
(213) 353-5929

Microsoft Corporation
10700 Northup Way
Bellevue, WA 98004
(206) 828-8080

Personal Systems Technology, Inc.
22957 La Cadena
Laguna Hills, CA 92653
(714) 859-8871

Sigma Designs, Inc.
P.O. Box 3765
3866 Eastwood Circle
Santa Clara, CA 95055
(408) 496-0536

TecMar, Inc.
23600 Mercantile Rd.
Cleveland, OH 44122
(216) 464-7410

Xedex
1345 Avenue of the Americas
New York, NY 10105
(212) 489-0444

The following firms also manufacture add-in memory for the IBM Personal Computer. All were invited to represent their products in this evaluation.

CTI
965 W. Maude Ave.
Sunnyvale, CA 94086

DG Electronic Developments
700 South Armstrong
Denison, TX 75020
(214) 465-7805

Maynard Electronics
P.O. Box 3322
Longwood, FL 32750
(305) 869-8058

Quadram Corporation
4357 Park Dr.
Norcross, GA 30093

Ratcom, Inc.
7620 S.W. 147 Ct.
Miami, FL 33193

Seattle Computer
1114 Industry Dr.
Seattle, WA 98188
(206) 575-1830

Zobex
7343 J. Ronson Rd.
San Diego, CA 92111
(714) 571-6971

Tall Tree Systems
1036 Los Altos Ave.
Los Altos, CA 94022
(415) 941-8748

I discovered that the following companies also make add-in memory boards for the PC too late to include them in this evaluation.

Legend Industries, Ltd.
2220 Scott Lk. Rd.
Pontiac, MI 48054
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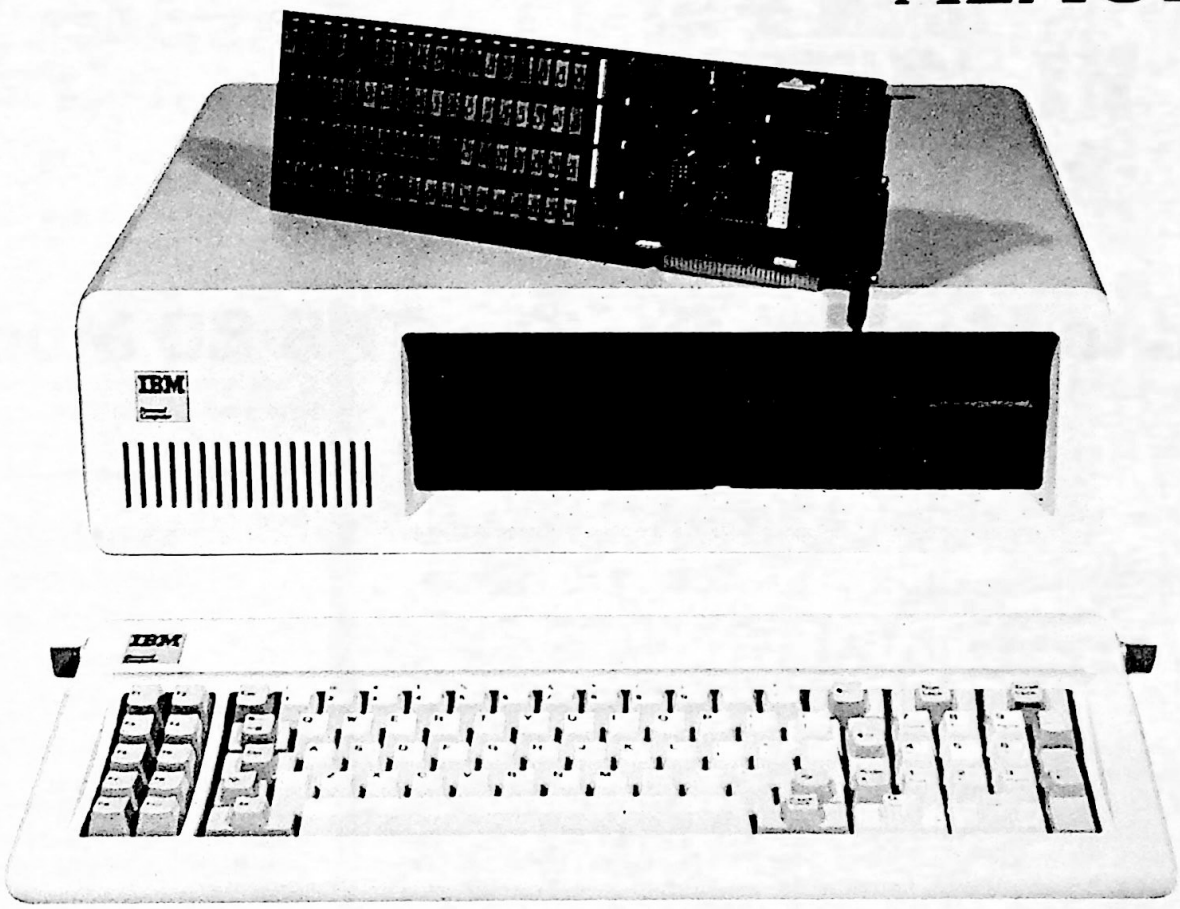

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CIRCLE 112 ON READER SERVICE CARD

Add-In Memory For The TRS-80 Model I

Robert E. Wilson

Several hundred thousand people bought the TRS-80 Model I, making it one of the most successful personal computers ever built. It really is a great machine, and was responsible for introducing many people to the world of computers.

As we become more ambitious with our programs, the message "?OM Error" begins to appear. Upgrading from 4K to 16K of memory makes things better for a while, but the message comes back; no programmer has ever complained of having too much memory space.

There are several ways to increase the memory size of the TRS-80, but they are all expensive, and they all have advantages and disadvantages. Which one is the best?

Inside The TRS-80

Before answering that question, let's look inside the memory structure of the TRS-80. The machine is built around the Z-80 microprocessor chip, which is designed to address up to a maximum of 64 kilobytes of memory space. So why does Radio Shack advertise only 48K?

The first 16K is reserved internally, for the Basic language interpreter and the operating system, which are recorded in a Read-Only-Memory, or ROM, so that they will always be available when the machine is turned on.

Robert E. Wilson, 343 Franklin Street, Mountain View, CA 94041.

Other things located in this first 16K are the keyboard and the video display memory. This is true for all versions of the TRS-80 Model I. So if you bought a 4K machine, it is really a 20K machine, 16K reserved, plus 4K user memory. Similarly, a 16K machine is really a 32K unit. You can add another 32K, for a maximum of 48K of user memory, plus 16K reserved, for a total of 64K.

Additional Memory Possibilities

There are several ways to add more memory. Radio Shack sells an Expansion Interface with up to 32K of memory for $497. LNW and Micro Designs sell equivalent kits that can be assembled for $250-$300. The latest option is a small circuit board designed by Larry Holmes, which can be installed directly inside the keyboard unit of the TRS-80 Model I. The IM-1 (16K) and the IM-2 (32K) are easy to install, inexpensive, and very reliable.

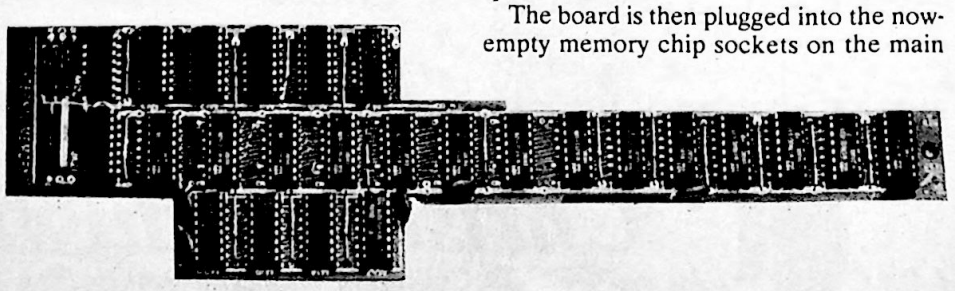
The Holmes board offers several advantages: There are no other units or cables to add to the system. The short leads resulting from the internal installation avoid timing delay problems that plagued even Radio Shack through three versions of their Expansion Interface. Interference generation and susceptibility are not changed, while the Expansion Interfaces from Radio Shack and others often made the interference much worse.

The Holmes board can even be used by owners of other expansions who need them for other features; disabling the other memory and adding this unit will reduce the memory error rate and number of system crashes.

The Holmes IM-2

When you purchase the Holmes IM-2, you get a circuit board that is about 3"x 10.5". It contains space for 24 memory chips of the 4116 type, 16K by one bit. The original eight chips from the keyboard unit are removed and reinstalled on the IM-2 board, which has space for 16 more chips, providing 48K of memory space in all.

The board is then plugged into the now-empty memory chip sockets on the main



circuit board of the computer where it draws its power from the lightly-loaded +12V supply, rather than the heavily loaded +5V supply, so the keyboard unit isn't overloaded.

The particular Holmes IM-2 unit tested had Motorola MCM4116BC20 200-nanosecond chips installed. They were tested at twice the normal clock speed without any errors.

Installation

Installation of the board is easy, if you follow the informative instructions supplied with it. Remember, however, that opening the case of the TRS-80 will void your warranty if it is still in effect. Installation is as follows:

1) Open up the case by removing the six self-tapping screws from the bottom of the case.

Installation of the board is easy, if you follow the informative instructions supplied with it.

2) Remove the original eight memory chips (4K or 16K) from the sockets labelled Z13 to Z20.

3) Install these (16K only) memory chips on the Holmes board in sockets M1 to M8.

4) Install the Holmes board into the now-empty sockets Z13 to Z20.

5) Attach the four flying leads to the designated points of the main board (RAM*, CAS*, A14, and A15).

6) Reassemble the case with the six screws.

That is all there is to it. Troubles with the installation are very rare, as all units are tested before shipment. There is help available at the other end of the phone at either Holmes Engineering or the Exatron Corp., and both companies are courteous and helpful.

The board can be purchased directly from Holmes Engineering, 3555 South 3200 West, Salt Lake City, UT 84119, (801) 967-2324; or from The Exatron Corporation, 181 Commercial St., Sunnyvale, CA 94086, (408) 737-7111.

From Holmes, the IM-1 sells for $59.50 and the IM-2 sells for $89.50. Both versions come with sockets for all memory chips, and eight-chip sets are an additional $26. From Exatron, the IM-2 sells for $124.50, and has 32K of memory soldered onto the board, with sockets for your original 16K set. □

CIRCLE 304 ON READER SERVICE CARD

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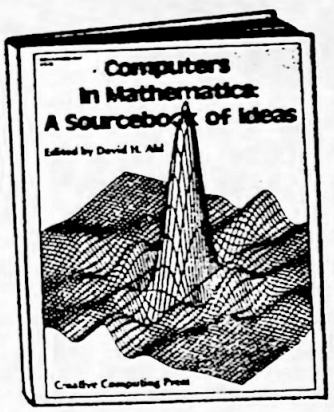

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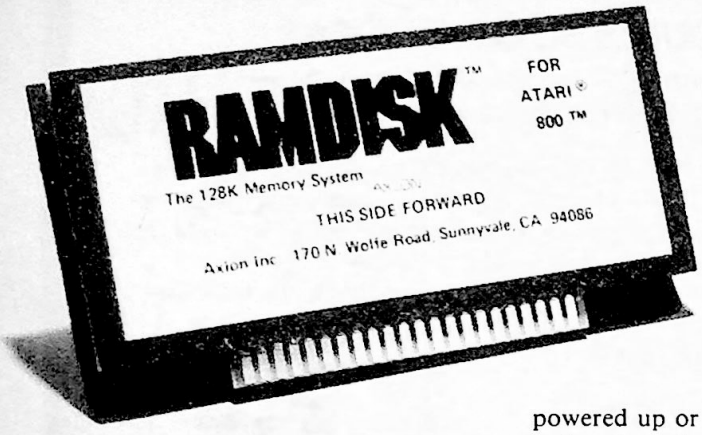
128K Memory System for Atari

David Small



A while ago a group of employees left Atari and formed Axlon Co. to manufacture add-on products for the Atari computer. They produce a 32K RAMCram card, and a 256K RAM system, complete with expansion interface.

So when ads began to appear for their RAMDisk, I was intrigued. I couldn't resist calling them for more details.

They turned out to be most friendly and mailed me a loaner RAMDisk for evaluation. This review is based on my use of the product for a month.

The RAMDisk arrives in a 9" x 11" x 1" blue box which contains a manual, a diskette, and a memory cartridge. The manual is housed in an attractive notebook with the diskette in a side pocket.

The memory board looks like an Atari 16K cartridge except that it has no top or sides. (It does have front and back covers, though.) This is probably to help the RAMDisk get rid of heat.

The manual is well written, and very, very clear. I decided to trust it immediately, and began following the setup directions.

Getting Started

First, one boots up the system with a normal Atari 2.0S DOS disk. The Axlon disk is fast formatted and uses Atari directory formats and such, but does not contain DOS.SYS or DUP.SYS, so you can't boot up with it. Next, I ran a Basic program called CREATE to create a boot disk (a disk used whenever the system is powered up or re-booted). Following the instructions, I put in the Axlon disk, then a blank disk, and created a boot disk. No problem—very easy to do.

Next, I turned the computer off, removed my middle 16K board, and put in the RAMDisk. Two memory boards are required, for some reason, on either side of the RAMDisk. Perhaps they keep it from getting the electrical equivalent of lonely.

Then, I booted up using the new boot disk. A most foreboding message flashed onscreen for about five seconds, just long enough for a speed reader to comprehend it. It pointed out that the Axlon MMS (Memory Management System) was an end-user initiated change to Atari DOS and that Axlon doesn't condone making copies and distributing them.

Here is my first complaint with the MMS, Axlon's DOS 2.0S: you have to sit through this silly legal message *every* time you boot up with the MMS disk. The first time, it's fun, and even witty. The second time, half witty, and after that, not funny at all. I was ready to disassemble the boot file and "short out" the message after a month of seeing it.

Once you're through the message, you get to Basic or whatever you're running. The RAMDisk hardware operates just like a normal 16K cartridge unless you specifically tell it not to. There's just about the same amount of free memory as before. So I typed DOS.

Next surprise. No click, whirr of the disk. The DOS menu popped up right away, just like the old DOS 1, but apparently without the memory sacrifice, according to FRE(0). And my, how the DOS menu has changed.

The Menu

First, the top line is not Atari 2.0S anymore. It is the Axlon RAMDisk MMS System V1.0. Most of the options look the same, but two are disabled: writing DOS files and creating MEM.SAV.

Second complaint. I don't care about MEM.SAV; I never use it. But I want to be able to write the DOS files after formatting a disk. The DOS and DUP files are on nearly every disk I have, making for few bootup problems. But Axlon doesn't want complaints about folks copying DOS, so they disabled it. Aside from these two changes the menu is a duplicate of the Atari 2.0S menu.

How do you use the RAMDisk? The RAMDisk contains 128K bytes of memory. A diskette contains around 90K. So the Axlon MMS makes "disk #4" the RAMDisk memory area. You literally use the 90K of the memory board as disk number 4.

You can copy to it, open files on it, close them, NOTE/POINT them, and so forth. You can copy an entire disk to RAM. You can run directories, lock files—everything you can do to a normal disk—to the RAMDisk (disk 4). In short, the RAMDisk replaces disk 4.

Here's an example. Let's say I have one disk drive and I need to duplicate a disk. I load the Axlon MMS, go to DOS, and J (duplicate disk) from 1 to 4. This copies the whole diskette into RAM. Next, I put in my destination disk, and copy from 4 to 1. All done. (No more swapping diskettes back and forth.) This is very nice and very easy. It is also fast. I could load 220-sector binary files in less than a second from the RAMDisk. This compares to more than 30 seconds for a disk drive.

Software houses should take note here. The RAMDisk is a very good thing for

David Small, 11314 Yucca Dr., Austin, TX 78750.

you. Let's say you need to make 100 copies of a given diskette. Without the RAMDisk, you can either use two drives—one to read the master and one to write the destination disk (wearing the master and its drive out)—or use one drive and swap disks like mad. With the RAMDisk, you copy the master into RAM, then proceed to make your copies from RAM. This product would well pay for itself in saved time and disk drive wear—heavy use is hard on Atari drives. (By the way, I found that DOS and DUP did copy if I used the DUP DISK option; you just can't create them originally).

From Basic Assembler, and so forth, the RAMDisk is just disk 4. SAVE or LOAD; the operations run very fast. Anyone with a program that is running slowly due to disk I/O should look into the RAMDisk. A speedup factor of 20 would be easily achieved, and that's conservative. In addition, you needn't put up with disk errors and the like.

This is a solidly built, well documented product.

How It Works

By now you're probably curious how this thing works, so here's what I found (in the manual, all clearly laid out). In the Atari, the address space from 4000 to 7FFF is normally the second 16K board installed in the machine. The RAMDisk allows 4000-7FFF to be any of eight individual 16K boards, one at a time. Due to many arcane hardware considerations you can't access all 128K at once, only a 16K chunk of it. But *which* 16K is instantly selectable. This is called "bank selection."

For example, Axlon apparently puts their MMS DOS Menu on one of the 16K banks. Then, to switch to DOS, they just select that particular 16K, and run (that's why DOS comes up so fast). But also note that DOS does not take up normal 16K programming space this way; the contents of the 16K you were working in before you typed DOS are on another of the 16K boards, ready for use as soon as it is reselected. (The MMS handles the swapping back and forth to use the 90K disk area).

If you're confused, just imagine you have a pile of eight 16K memory boards and you could plug or unplug them at will into the middle slot. This is how the Axlon board works.

This product could well pay for itself in saved time and disk drive wear.

Physically it uses Motorola 64K x 1 chips. The raw cost of the chips on the board I calculated to be around $250, so the price of the board is quite reasonable. The construction of the board is very high quality.

Uses

Extremely high speed animation is possible using bank selection. You don't have to use the Axlon board as a RAMDisk. You can select which 16K you want directly. So several images (display lists and memories) can be stored, and switching between them determines which image is being displayed. Some impressive effects could be obtained (only) this way. Alas, I didn't have time to do much of this.

One thing I did use the system for was holding temporary files during developmental work. By having the RAMDisk hold various versions of a Basic program I was developing (with SAVE), I greatly speeded up the development time. However, there is a problem with this: turning the Atari off causes the contents of the board to be lost. And I have locked up the Atari past RESET working many, many times.

The diskette that comes with the RAMDisk also has several options to check the board out and fiddle with MEM.SAV. It even has a complete copy of the manual (over 300 sectors) as files.

Disadvantages

And now I come to the parts I don't like about the RAMDisk.

I have already mentioned a few points, but my main problem with this unit is that it is a limited function device. It is like a plotter; some people can use it, others can't. Software houses and people with heavily disk-bound programs could make great use of this product. People who need incredible animation memory also could. But I can't for the life of me think of another use for it. It was a nice convenience when copying disks, but it just wasn't that great a help. It would take a volume operation for it to make a difference. For your average Atari user, another disk unit, which costs the same (or even a bit less) is probably a better buy. You can just do more with it.

Technical Aides

The bank selection is done in the C000 area, currently unused by Atari. My Atari sources tell me this will change in a year or so, as the operating system acquires more capabilities. The Axlon people will have to modify their board at that time.

Sector copying programs do not work with this board.

Microsoft Basic has real problems with this board. I tried the whole month to get them to work together and couldn't. As the new Basic is just plain wonderful and everyone will be buying it, the Axlon people had better get some new software out fast.

The board throws only minimal RF interference, and if you run your Atari without the top cover on for heat dissipation, you will notice minor wavy lines on your TV.

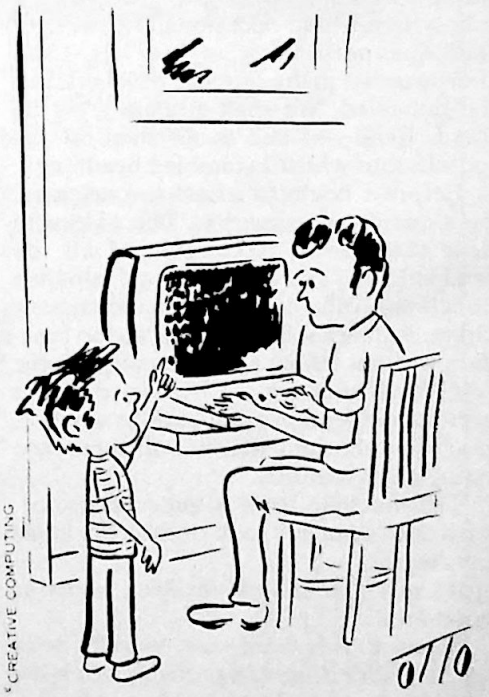
Axlon plans a RAMDisk for Apple II and Apple II Plus computers in the near future.

Conclusion

This is a solidly built, well documented product. It has several very useful applications. People who can use it in those applications will be most pleased with it. But those who want high speed disk I/O or temporary storage will not find it of much use. It certainly expands the capabilities of the Atari, but you may not need your capabilities expanded in that direction. Consider it as you would a piece of other special purpose peripheral equipment, such as a digitizer or modem. Will you use it? If so, it is a good product.

RAMDisk, Axlon Co., 170 N. Wolfe Rd., Sunnyvale, CA 94086. $589. □

CIRCLE 320 ON READER SERVICE CARD



*"When you're through Dad, I want to write a program to experiment with the effect of a different coefficient on a plot of a polynomial of the form Y(X)=A*X↑2+B*X+C"*

What a Difference a Drive Makes

John Anderson

This started out as a hardware review, but it didn't stay that way for long. It became a tutorial for a while. Still wasn't right. It worked its way into a program, and that by no means signifies that it is finished. But it's a start.

When a VIC-1540 disk drive appeared at the office, I rejoiced. I knew the breakthrough this product represents to VIC-20 owners. It was momentous: over 160K of on-line RAM; the speed and convenience of floppy disk storage. Putting aside the cassette recorder, with its well known peculiarities, presents the opportunity to expand the VIC into a "real" computer. I had been meaning to get to know the VIC—this seemed like the time to do it.

Boon or Boondoggle?

Though it is more than twice the price of the VIC-20 itself, the 1540 is a potential boon. Unfortunately, it carries a few potential boondoggles with it as well. It takes a while to become familiar with the idiosyncratic and occasionally downright baroque personality of the VIC-1540. Fortunately, many of these problems can be remedied. We shall attempt a big fix here. Read on, and avoid some of the pitfalls into which I stumbled headlong.

Before I begin to sound too negative, let's qualify the situation. The 1540 with few exceptions, is capable of all the sophisticated and powerful data handling functions available to any microcomputer drive. Remarkably, it is designed to function without taking up any memory in the VIC-20. If you are a VIC owner who is serious about microcomputing as a hobby, you will want the 1540, and will appreciate many of its features.

The machine itself is quite handsome, with the "slimline" look of the very latest hardware.

If only the documentation were as good-looking.

A few ROMs from now, working with the 1540 disk drive will probably be child's play. Right now it's work. I heard from a VIC-20 owner who requested a demonstration of the drive at his local dealer. He became discouraged when the salesperson couldn't manage to produce a disk directory, no matter how hard he tried.

When you take a look at the documentation, you find it hard to blame the salesperson. The documentation makes a tough situation worse: transposing I's with 1's and 0's with 0's, dropping integral commas, and printing hard to decipher listings. It contains neither an index nor a glossary.

In toto the documentation does just about all it can to ensure the onset of depression in beginners. The VIC-20 has gained a reputation as an excellent learning machine. For the novice, learning to use the disk drive is a trial by fire.

Beware of any bit of writing that chooses to *begin* with a recommended reading list.

The documentation does just about all it can to ensure the onset of depression in beginners.

To me, it seemed akin to a mystery novel—every few pages a paragraph would leave me trembling, covered with goosebumps, teeth a-chattering, hair standing on end. Immense puzzlement would follow. The excitement was nearly too much to take.

Things to Watch Out For

My first thrill came early. As I was able to piece together, *initialization* and *formatting* are two very different functions to the 1540. Formatting means creating tracks and sectors, sync characters, block headers. This is an altogether orthodox use of the term.

In contrast, initialization means updating the disk memory map, "BAM," as it is called. This stands for "block access map," as opposed to whatever you may be thinking. The map resides on track 18, sector 0 of every VIC disk. As long as unique extenders are used along with your "disk file name," you won't need to initialize a disk more than once.

Perhaps now you, too, are breaking into a cold sweat.

In order for the drive to ascertain whether to look for a new "BAM," each disk must have, besides its "name," a unique, alphanumeric identifier. In that way, the firmware DOS will always know when a new disk has been inserted. Otherwise, it would become necessary to reinitialize a disk each and every time it is inserted or reinserted into the drive.

Try to be brave, for I'm not finished with the bad news. If you are a beginner, hold on to something solid.

Nearly every command, no matter how simple in its result, calls for cryptic entry codes. This becomes annoying fast. VIC marketers have made much of the term "user-friendly." Perhaps their next catchword should be "user-murky." I'm sure that this will be disheartening to those who are just getting started in the hobby. For some examples, see Figure 1.

Object	Enter Command
To initialize disk	OPEN 1,8,15,"IO"
To format disk	OPEN 15,8,15,"NO:FILENAME,EXT"
To validate files	OPEN 1,8,15,"V"
To obtain disk director	LOAD "$0",8,LIST

The documentation exacerbates the obscurity of the cryptic command codes used by the drive. I consider these to be the most serious drawback of the 1540 in its current incarnation. I'm close enough

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CIRCLE 117 ON READER SERVICE CARD

VIC-1540 Disk Drive Specifications.

Media	5.25" single sided, single density diskettes
Total capacity	174,848 bytes per diskette
Sequential	168,656 bytes per diskette
Directory entries	144 per diskette
Records per file	65535
Sectors per track	17 to 21
Bytes per sector	256
Tracks	35
Blocks	683 (19 used by BAM)
Power consumption	25 watts

to being a beginner myself to realize how discouraging things like this can seem when you are just about treading water. You will hear more about this later.

Another possible snag develops when resaving altered versions of a program. With disk operating systems, resaving a file under the same name saves the new version of the file. Not so with the 1540: nor will it come back with an error message. It will allow you to "resave" old file names to your heart's content—without altering a hair of the original file saved.

Save progam revisions under new and unique filenames. Then you can delete the original file, followed by renaming your latest version with the deleted, original filename.

The 1540 is currently incapable of copying a file to any but the disk containing the source file itself. The obvious way around this is to load the file into memory, then save it to a new disk.

With its own 6502 microprocessor, and DOS resident in ROM firmware, the design of the 1540 ensures that maximum RAM memory will remain available in the VIC-20. The implication here is that the 1540 is an "intelligent" drive; however I would rather hate to have to administer an I.Q. test. A great deal is left to the user's intelligence to get right. It is as if *your* memory is used as a buffer to conserve computer memory.

Baby Driver

Some readers may not share my vehement dislike of cryptic command codes. I'll admit I sometimes overreact to them. However I do feel strongly that computers should make things as easy as possible to do right. As it stands, the 1540 sure makes it easy to get things wrong. For that reason I have created a menu-based command system for the VIC-20, to be used in conjunction with a single disk drive. I am sure the program will help initiates to get going with their new 1540—which in turn will help them learn about the way the drives work. The program simply provides a "mini-DOS menu," allowing for many command functions at the touch of a key. This in no way precludes more sophisticated means of accessing the commands.

Some type of menu program should be provided on the "Demo/Test" disk that is shipped with the drive, but is not. I strongly suggest that all 1540 owners type the following program, and put a copy of it on every data disk they generate.

This will leave more of your brain memory free for the important stuff.

There is a function to call up a disk directory, without having to exit into a separate program listing, the bizarre approach outlined in the documentation. Formatting, initialization, copying, renaming, erasure, validation of files, are all available by keystroke. The program will even write a copy of itself to disk (highly recommended).

In addition, DOS errors can be translated quickly and painlessly. When the busy light blinks an error condition, the error number, explanation, and track and sector numbers (if applicable) can be displayed.

How to Make It Better

VIC mavens will want to improve on this program. Obvious areas for improvement are checking for the legality of filenames and extenders, and allowing for escape from menu commands. The program could be crunched into considerably less memory, as well.

The VIC-1540 will be an important tool for VIC-20 owners. Disk-based software promises a new level in program sophistication, capability, and versatility. It also offers third-party software developers with an obvious challenge: making the drive smarter and friendlier. □

Control Characters Used In The Listing.

Character	How to get it on the keyboard	Program line(s)
(inverse heart)	"shift" and "clear"	10, 250, 300, 350, 400, 450, 500, 550, 600, 670.
(inverse British "pound" sign)	"control" and "red"	262
(inverse R)	"control" and "9"	262, 276
(inverse underline)	"control" and "0"	262
(inverse left arrow)	"control" and "blue"	262
(inverse up arrow)	"control" and "green"	276

```
10 PRINT"□"
20 PRINT" VIC-1540 USER'S MENU"
30 PRINT"----------------------"
40 PRINT
50 PRINT"  1. DISK DIRECTORY
60 PRINT"  2. FORMAT NEW DISK
70 PRINT"  3. INITIALIZE DISK
80 PRINT"  4. COPY FILE
90 PRINT"  5. RENAME FILE
100 PRINT"  6. ERASE FILE(S)
110 PRINT"  7. VALIDATE FILES"
120 PRINT"  8. WRITE MENU FILE"
130 PRINT"  9. ERROR STATUS"
140 PRINT" 10. EXIT TO BASIC"
150 PRINT
160 PRINT"----------------------"
170 PRINT" INPUT NUMBER OF YOUR":PRINT" CHOICE, HIT <RETURN>
180 PRINT
190 INPUT CHOICE
200 ON CHOICE GOSUB 250,300,350,400,450,500,550,600,650,700
210 GOTO 10
250 PRINT"□"
251 OPEN 1,8,0,"$"
252 GET #1,A$,B$
254 GET #1,A$,B$
256 GET #1,A$,B$
258 C=0:IF A$<>""THEN C=ASC(A$)
260 IF B$<>""THEN C=C+ASC(B$)*256
262 PRINT"■■"MID$(STR$(C),2);TAB(3);"■■  ";
264 GET #1,B$:IF ST<>0THEN 282
266 IF B$<>CHR$(34)THEN 264
268 GET #1,B$:IF B$<>CHR$(34) THEN PRINTB$;:GOTO268
270 GET #1,B$:IF B$=CHR$(32) THEN 270
272 PRINTTAB(18);:C$=""
274 C$=C$+B$:GET #1,B$:IF B$<>""THEN 274
276 PRINT"■■"LEFT$(C$,3)
280 IF ST=0 THEN 254
282 PRINT" BLOCKS FREE■■"
284 CLOSE 1:PRINT:PRINT:PRINT"HIT <RETURN> FOR MENU":INPUT X$:RETURN
300 PRINT"□":PRINT:PRINT
305 PRINT"INSERT DISK TO BE":PRINT"FORMATTED.":PRINT
310 PRINT"INPUT DISK NAME":INPUT DISK$
320 PRINT:PRINT "INPUT EXTENDER NAME":INPUT EXT$
325 MACRO$="N:"+DISK$+","+EXT$
330 OPEN 15,8,15,MACRO$
340 CLOSE 15:MACRO$="":RETURN
350 PRINT"□":PRINT:PRINT
360 PRINT"INSERT DISK TO BE":PRINT"INITIALIZED.":PRINT
370 PRINT"HIT <RETURN> TO":PRINT"INITIALIZE":INPUT X$
380 OPEN 15,8,15,"I"
390 CLOSE 15:RETURN
400 PRINT"□":PRINT:PRINT
410 PRINT"INPUT SOURCE FILE NAME":INPUT DISK$
420 PRINT:PRINT "INPUT NEW FILE NAME":INPUT NWS$
425 MACRO$="C:"+NWS$+"="+DISK$
430 OPEN 15,8,15,MACRO$
440 CLOSE 15:MACRO$="":RETURN
450 PRINT"□":PRINT:PRINT
460 PRINT"INPUT OLD FILE NAME":INPUT DISK$
470 PRINT:PRINT "INPUT NEW FILE NAME":INPUT NWS$
475 MACRO$="R:"+NWS$+"="+DISK$
480 OPEN 15,8,15,MACRO$
490 CLOSE 15:MACRO$="":RETURN
500 PRINT"□":PRINT:PRINT
510 PRINT"INPUT FILE NAME(S) TO":PRINT"DELETE":INPUT DISK$
520 PRINT:PRINT:PRINT"HIT <RETURN> TO DELETE":INPUT X$
530 MACRO$="S:"+DISK$
535 OPEN 15,8,15,MACRO$
540 CLOSE 15:MACRO$="":RETURN
550 PRINT"□":PRINT:PRINT
560 PRINT"WARNING:OPEN FILES ":PRINT"WILL BE DELETED"
570 PRINT:PRINT PRINT"HIT <RETURN> TO":PRINT"VALIDATE":INPUT X$
580 OPEN 1,8,15,"V"
590 CLOSE 1:RETURN
600 PRINT"□":PRINT:PRINT
610 PRINT"INSERT DISK TO BE":PRINT"WRITTEN TO.":PRINT
620 PRINT:PRINT:PRINT"HIT <RETURN> TO WRITE":PRINT"MENU FILE":INPUT X$
625 OPEN 1,8,15
630 SAVE "MENU",8
635 CLOSE 1
640 RETURN
650 OPEN 1,8,15
660 INPUT#1,A,B$,C,D
670 PRINT"□":PRINT:PRINT
680 PRINT"ERROR STATUS":PRINT:PRINT"ERROR #
    ";A:PRINT B$;PRINT"TRACK ";C;"SECTOR ";D
685 PRINT:PRINT"0 = NO ERROR"
690 PRINT:PRINT:PRINT"HIT <RETURN> FOR MENU":INPUT X$:CLOSE 1:RETURN
700 PRINT"□":PRINT:PRINT
710 PRINT"NOTE: MENU PROGRAM IS":PRINT"STILL RESIDENT."
720 END
```


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CIRCLE 101 ON READER SERVICE CARD

Apple Word Processing Made Practical

Jack Trainor

Sooner or later all owners of personal computers are asked, "But what do you use it for?" Space Invaders is not the answer you want to give the skeptic, however true it might be. Learning Pascal sounds better, but is still not quite down to earth, unless you are studying to program professionally. VisiCalc is wonderful, but how many of us really need the power of an electronic spreadsheet in our personal lives?

As far as I can see, the microcomputer is great for learning about computers and playing games, but as a practical tool for the individual, the only area in which the personal computer can pull its weight is word processing.

Everyone writes. Students have their term papers. Most people have some business correspondence. Just about everyone writes letters (and wishes he wrote more). For me word processing was a revelation. It didn't solve the problem of what to write, but it sure made the process easier. Once you have gotten used to a word processor it is difficult to write in any other way.

Unfortunately, word processing really hits the weak points of my Apple II: the 40-column screen width and the all upper case keyboard. I decided to solve both problems at once by buying the Videx Videoterm board, which expands the Apple screen to 80 columns and provides good looking upper and lower case letters with true descenders. It is a fine, reliable product about which you probably know already. It does have one serious drawback, however: it requires you to press four keys to capitalize one letter. This is not acceptable for word processing. Don't let anyone tell you differently.

Most word processors for the Apple II use some scheme that allows easy capitalization. With some programs you press a particular key, usually ESCAPE, and the next letter typed will automatically be capitalized. This is almost painless, but still not as convenient as those nice wide shift keys provided on both sides of the keyboard.

Jack Trainor, 118 Norfolk St., Cambridge, MA 02139.

The One Wire Shift Key Modification

Consequently, the "shift key mod" has become very popular. This is just a wire running from pin 4 of the game I/O port to pin 24 of the encoder board that rides piggyback under the Apple keyboard. The result is a shift key "that works as Nature intended."

In addition to the shift key and lower case, the Enhancer provides auto and fast repeat, a type ahead buffer, the full ASCII character set, and user definable keys.

The catch is that it only works with software specifically written for it. Many word processors can be configured to work with the shift key mod. So, if you don't care about the shift problem outside of word processing, the shift key mod is a cheap, simple solution.

Videx has not publicized it, but the new versions of firmware (2.3 and later) for the Videoterm 80-column board will support the shift key mod. So with one of the new PROM chips in your Videx board and the shift mod in your system, your shift key will function whether the software checks for it or not.

The Videx Enhancer II

Nonetheless, the shift mod is a kludge. For some time Videx has offered the Keyboard and Display Enhancer (mercifully known by its acronym, KADE), which gives you a working shift key and lower case for the 40-column screen, but not much else for $129. Since I don't care about the 40-column screen, this seemed a little steep for just a working shift key.

Recently, however, Videx announced the Enhancer II which is a complete reworking of the KADE. For only $20 more the Enhancer II has some powerful features that make the Apple Keyboard comparable to that of a quality computer terminal. In addition to the shift key and lower case, the Enhancer provides auto and fast repeat, a type ahead buffer, the full ASCII character set, and user definable keys. I will explain these in order, with particular attention to the last.

Auto and Fast Repeat

When you press a key down for more than 3/4 of a second with the Enhancer, the key will automatically repeat. That is auto repeat.

If you press the REPEAT key at the same time the key will repeat even more quickly. That is fast repeat, and it is fast. The cursor seems to blaze across the screen.

These two features may seem minor, but since typing is so interactive they are easily noticed and appreciated. A quibble: I wish that the auto repeat would cut in a little sooner than 3/4 of a second.

Type Ahead Buffer

A regular Apple has only a one-char-

acter buffer in which to store characters arriving from the keyboard while the 6502 microprocessor is attending to other operations. Each new character typed in will wipe out the previous character in the buffer until the 6502 has a chance to process the input.

The Enhancer II supplies a 128-character type ahead buffer. So, theoretically, you could type in a sentence or a series of commands while saving a file to disk, and your input would not be lost. In practice it doesn't always work that way, since some software seems to flush the buffer as an accidental side-effect.

The type ahead buffer and fast repeat features can interact in unexpected and sometimes unpleasant ways. For instance, with *WordStar* you can delete surprisingly large chunks of text by pressing the left-arrow and REPEAT keys. Press those keys a little longer and the screen begins to fill with exclamation points as the Apple speaker sounds an alarm. It is unnerving, but if you can keep your head and not hit RESET, *WordStar* will finally regain control.

Luckily, the folks at Videx have anticipated these hazards. The type ahead buffer and fast repeat can be disabled, as can the other features. So you don't have to worry about the Enhancer II interfacing with any of the software you want to run, including games.

User Definable Keys

User definable keys are also known as macros. With the Enhancer you can define a single keystroke (a character key alone or with the control and/or shift) to be equal to one or more other keystrokes. For example, in Apple DOS you could define CONTROL-C to be equal to CATALOG. Any time you wanted to see the contents of a disk you would just type CONTROL-C. The full command CATALOG would appear on the screen and the command would be executed. Obviously macros are ideal for speeding the entry of frequent commands, long variable names, or any other string of characters that is used often.

However, macros might seem to be limited since many of the control codes are already defined. In the above example you would lose the break function of CONTROL-C by making it a macro for CATALOG. Actually the best choice would be to define CATALOG as Shift-C instead, which may seem odd because C is already capitalized. Here it is necessary to explain the most confusing aspect of the Enhancer II (other than the manual).

Apple Mode and Typewriter Mode

With the Enhancer you gain lower case and the shift key, which I will call the typewriter mode, but you don't lose the ll-caps mode of the normal Apple keyoard. You switch between these modes y pressing SHIFT-RESET for typewriter mode and CONTROL-RESET for Apple mode.

Although it makes no difference on the screen, the Enhancer can distinguish between C and SHIFT-C. This is the trick that allows you to define macros mnemonically without canceling out control codes or losing letters of the alphabet. It is true that it works only in Apple mode, but then I use macros mostly while editing programs. In typewriter mode, macros are best defined using CONTROL with numbers or punctuation.

Defining Macros

Macros can be defined directly from the keyboard, or you can run the Macro Editor program. Macro Editor allows you to save a group of macros to a file on disk. Then you can BRUN the macro file and the macros will be downloaded into the Enhancer for immediate use.

Videx offers excellent support over the phone.

Lower Case on the 40-Column Screen

Lower Case on the 40-column requires a 16K RAM card. The Enhancer II gets lower case on the 40-column screen by modifying a disk version of Applesoft, then loading this Applesoft into the RAM card to be used instead of the ROMs on the Apple motherboard.

The manual also explains how you could burn this version of Applesoft into a PROM and use the PROM on a ROM card—a rather unlikely solution. However, you can't get lower case at all for the 40-column screen on Apples that are Rev. 0-6. For these Apples you must use the KADE for 40-column lower case.

Full ASCII Character Set

I should also mention that the Enhancer gives you all 128 characters of the ASCII character set. From the keyboard you can easily enter braces, brackets, backslashes, vertical bars, and underscores.

Documentation

Sometimes you can spot bad documentation without even reading it. A couple of poorly reproduced pages fall out of the package, and you know you are on your own. Other times it's not so simple...

The Enhancer II manual is attractively presented in the standard Apple format—a small spiral notebook with glossy paper and a color cover. It is over a hundred pages long. You can tell that some time and expense went into it, but for all of that, the manual is dreadful.

First, it is organized poorly. You have no choice but to leapfrog from one forward reference to the next and the next. Finally, you reach the end of the manual and your question is still unanswered. Naturally there is no index.

Second, the manual goes into detail on the obvious, then glosses over the difficult. Auto and fast repeat are explained three times, and then defined in the glossary. The act of downloading is dismissed in two misleading sentences. Frequently, reading the manual left me feeling even more confused.

Support

On the bright side, Videx offers excellent support over the phone. I called five times. I had no trouble getting through and my questions were always answered with patience and accuracy.

Installation

The Enhancer II is much easier to install than the KADE, and the instructions are extremely detailed. It is just a matter of replacing the Apple encoder board with the Enhancer and running two wires (without soldering) from the keyboard cable socket to two chips on the motherboard. Nonetheless, if you don't feel comfortable with needlenose pliers and wirecutters, you should probably have your dealer install the Enhancer.

Summary

I have been using the Enhancer for two months now and I still think it is a good buy. While I would survive without it, I have grown accustomed to its conveniences. I recommend it to other Apple users—particularly programmers. The novice might want to wait until he is more familiar with the Apple, since the Enhancer II adds some complications to keyboard input.

In a business environment I suggest that someone familiar with Basic and Apple DOS be assigned to learn the ins and outs of the Enhancer to head off any problems that might arise.

Videx Corporation, 897 Northwest Grant St., Corvallis, OR 97330. □

CIRCLE 305 ON READER SERVICE CARD

New Graphics Horizons for the PET

Carl Strobel

Each time I tell myself that I've tried everything my computer has to offer—games, data processing applications, machine language programming, word processing—another door opens and I get a glimpse of a totally new horizon.

The latest world to conquer, and the most fascinating by far, is that of high resolution graphics. The possibilities seem almost as limitless as those which opened up when I first sat down with my brand new personal computer.

I've created a three-dimensional representation of my house and viewed it from any number of positions (including an underground worm's eye view), tracked satellites across a map of the world, designed a kitchen by moving cabinets and appliances around a three-dimensional room layout, created computer art and written in Japanese, and still I've just scratched the surface. There is a myriad of other uses, educational, business, personal and just plain fun (how about a cockpit view of landing a jet aboard an aircraft carrier, or a periscope attack on a merchant convoy).

The key to providing my PET with a relatively low cost, yet versatile high resolution graphics capability was the superbly conceived and engineered Visible Memory produced by Micro Technology Unlimited, 2806 Hillsboro St., Raleigh, NC 27605.

Carl Strobel, 1716 Tarleton Way, Crofton, MD 21114.

How It Works

The Visible Memory is based on a beautifully simple concept. To best understand how it works, let's take a quick look at the way graphics are created on the PET screen (the same principles generally apply to other microcomputers).

There are two methods commonly used to generate graphics on a computer screen. In vector graphics, found in more expensive computers, the desired shape is drawn on the face of the CRT. To make a 2" line slanting at a 17-degree angle, the electron beam is turned on at the starting point of the line and makes a trace two inches across the face of the CRT at a 17-degree angle.

Raster graphics, used in most personal computers, is a little less direct. The electron beam moves in horizontal sweeps across the screen and is turned on and off in pulses, effectively making individual dots of light on the screen. The letter "T," for example is formed by turning the beam on for several consecutive pulses to form the crossbar, then adding the necessary dot in each of the next few horizontal sweeps to form the stem of the letter.

The raster method, while it does have some advantages, obviously produces a coarser picture. In practice, it also means the user is generally limited to those graphics symbols designed into the computer.

The PET screen is divided into 1000 blocks, 25 rows of 40 blocks each, in which a letter, number or graphics symbol can be displayed. Each block is composed

Figure 1. The Japanese character "Nihongo," meaning "Japanese language," as drawn by the Visible Memory. Any non-Roman alphabet can be produced.

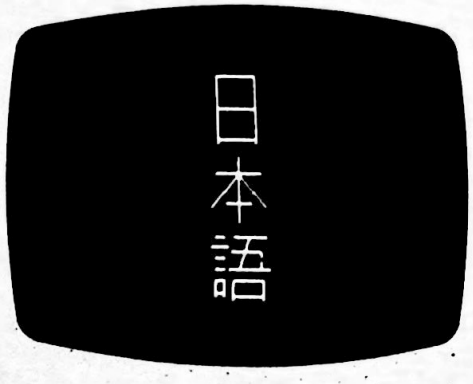
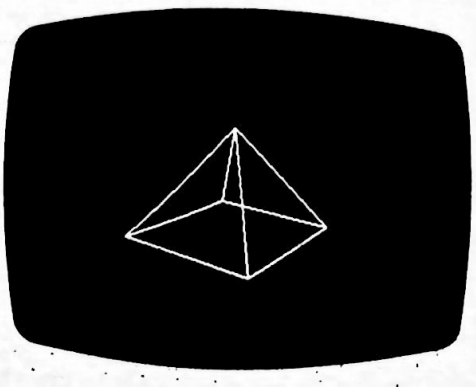


Figure 2. A simple perspective drawing of a pyramid.



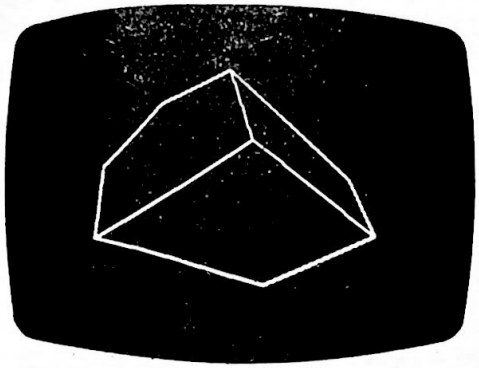


Figure 3. A perspective view (with hidden lines removed) of the author's house, as viewed from below—a worm's eye view.

of 64 potential dots of light called pixels, arranged in an 8 x 8 square. The pixels within a block are lit up in various combinations by the raster method described above to form any of the predefined symbols chosen by the user or designated by his program. In practice, the lefthand column and bottom row of pixels in each block are kept dark when forming alphanumeric characters in order to provide spacing between characters and between lines. But these pixels are available to form other symbols.

The graphic set of the PET is impressive, but it is also limited. In perspective drawings, for example, you can only create lines that are horizontal, vertical or at a 45-degree angle. Some clever art work has been accomplished using the graphics set (for example, the baseball players in Karl Savon's Batter Up! and the animated cartoons in *Cursor* magazine), but realistic or detailed drawings are not possible.

Consider, however, what would happen if you could light up any pixel you wished. You could not only draw lines at various angles to display objects in realistic perspective, but you could create any shape on the screen that you wanted—a map of Australia or the Chinese characters for "martini."

Enter the Visible Memory. Each bit in its 8K bytes of memory controls one pixel on the screen. Store a value of 1 in the bit and the pixel is turned on; a value of 0 keeps the pixel dark. The VM thus gives the PET owner 64,000 possible points of light with which to draw. They are arranged in 200 rows of 320 points each. The VM also includes several other very clever features which I will discuss later.

The key to the operation of the VM is an on-board graphic video generator which uses two of the inputs from the PET video display logic and adds a signal of its own. The PET generates vertical and horizontal drive signals used by the sweep circuitry

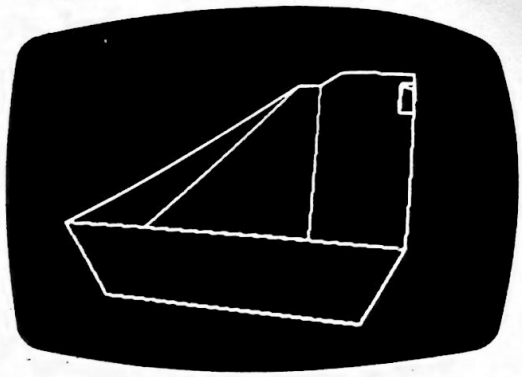


Figure 4. Flying a PET onto a carrier deck. The view is from a point 200' aft and about 50' above the flight deck.

in the monitor to control the movement of the electron beam across the face of the CRT. The PET also generates a display signal which turns the beam on and off to create graphics characters in the manner described above.

The VM video generator synchronizes itself with the two drive signals from the PET and creates its own video display signal which turns the beam on and off as directed by the graphics software, giving the user the ability to light individual pixels. Moreover, through a simple POKE command the user can select either PET video or VM video or overlay the two.

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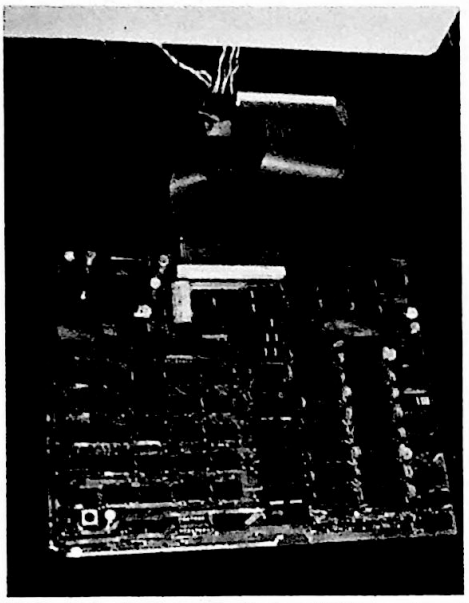


Figure 5. A closeup of the VM board and interface.

The overlay capability has been added to the latest version of the VM and gives the user added flexibility by allowing the PET alphanumerics set to be used with VM graphics. One practical application is to display place names on a VM-generated map at the user's request. A handy feature for teaching geography.

Another POKE command blanks the screen without affecting the PET or VM graphics in memory. This makes possible animation and other striking visual effects.

Additional Features

As mentioned earlier, the VM offers several other highly useful features not directly related to graphics. The board has five ROM sockets accessible by software command to allow use of the growing number of ROM programs, such as the Programmer's Toolkit and the Commodore Word Processor. The board also contains a light pen register (you supply the IC's) for additional flexibility in expanding your system. The comprehensive VM manual tells all you need to know to hook up the light pen and write the software necessary for its operation.

The ROMs, the visible memory and a KIM bus are all accessed through an enable control register using a POKE command. By setting the appropriate bit in the register, any of the devices may be made available as needed. It all sounds much more complicated than it really is; a chart in the VM manual explains what decimal value to POKE into the address in order to turn on the various devices. Jumpers are also supplied to allow the user to enable some of the devices at power-up.

The KIM bus, incidentally, allows the addition of other Micro Technology products such as memory expansion and a disk controller. Another Visible Memory can be added to provide gray scale graphics on an external monitor, using the bus.

But the one capability which made the VM cost effective for me was the ability to use its 8K of memory as additional RAM when not in the graphics mode.

This feature also gave me the only problem I have had with the VM. Initially I couldn't get my PET to recognize the existence of the additional 8K of RAM even though the VM worked perfectly in generating graphics. A little reflection and study of the VM manual showed that the unit as shipped had three ROM sockets enabled when the PET's power was turned on. The visible memory was then enabled by a POKE command to the enable control register. A quick change of jumpers to enable the memory at power-up solved the problem.

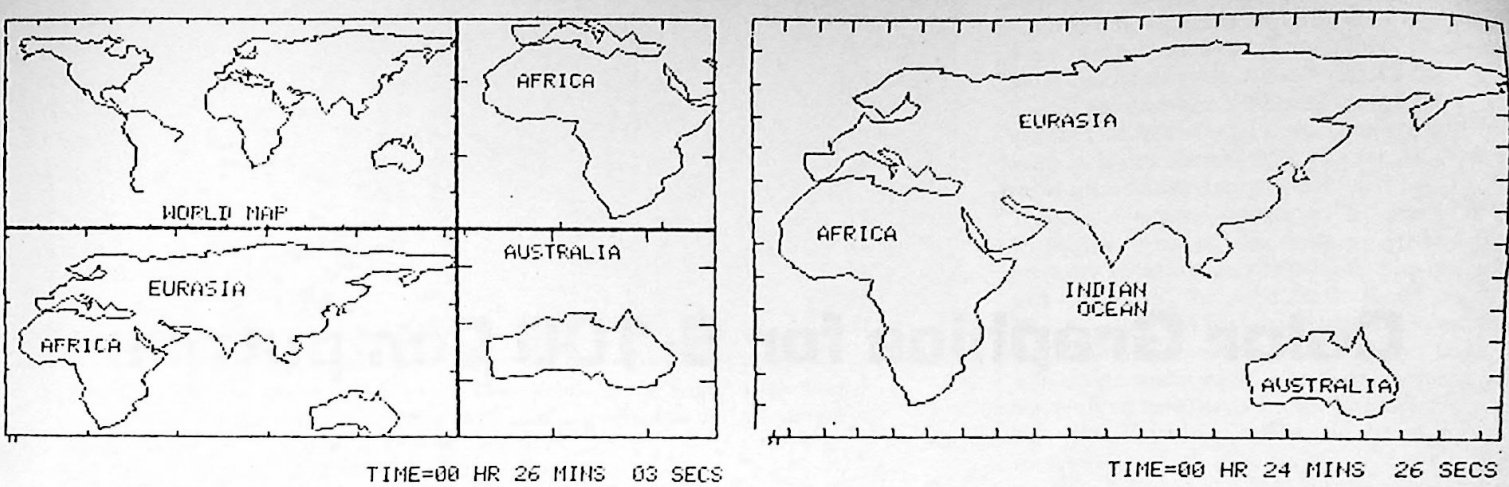
Installation

Installation of the VM is simple—and I speak as one who panics at the mere thought of opening the PET cabinet, much less touching anything inside.

The unit has two major components, the visible memory board itself and a connector board, along with the necessary cables. Two different types of connector boards are available to accomodate the varieties of PETs which have been produced.

The clear, step-by-step instructions provided in the manual give confidence to a non-hardware type such as myself. The connector board is plugged into the PET memory expansion connectors, three wires from the connector board are soldered to the large power diodes on the main logic board of the PET, the visible memory board is attached by cable to the connector board, another cable is plugged into the monitor circuitry of the PET, and the system is ready. The whole operation, including triple checking each step (I said I was cowardly about the inside of the PET), took 10 minutes. Brackets are available for mounting the VM inside the computer cabinet or the unit can be put in an external case.

Figure 6. The VM attached to the author's PET. The board can be mounted inside the computer chassis or protected in an external cabinet.



Figures 7 and 8. High resolution graphics printouts produced by a Commodore printer using a screen dump routine. The times show the amount of time required to print the contents of the screen—slow but effective.

The manual explains how to check each step of the installation, and a diagnostic program is included to verify proper operation of the memory when installation is finished.

Documentation

Technical documentation is excellent. There is a full description of the principles of operation, with schematics and pinout data included.

The manual contains a demonstration program in Basic for plotting a sine wave. The subroutines for converting X and Y coordinates into POKE addresses and values are easily adapted to a program of your own. The manual also explains the principles for programming the VM in Basic, along with the algorithms for calculating the byte address and bit number of any pixel.

Software

The easy way to program is to use the software package that Micro Technology offers separately. It contains a demonstration program that displays the impressive high resolution graphics capability of the system and has other programs which provide the ability to draw and write text. But most important, it contains machine language subroutines and a Basic interface routine which speed up the creation of graphics a hundredfold.

My three-dimensional graphics software uses those machine language subroutines to draw the figure. After calculating the coordinates of the two-dimensional projection of a given object, the Basic program calls the machine language routines to connect the vertices. It is much faster and less complicated than trying to draw directly with the Basic program.

For objects with many curved lines, such as maps, or with many short lines, such as Chinese characters, it is convenient to store the coordinates of the points as data statements and have a routine which reads them out and converts them to the byte addresses and bit values of the pixels.

In another language application, the PET keyboard can be converted to Hebrew. Each key represents a specific Hebrew letter. When a key is pressed the program draws the appropriate letter on the screen, writing from top to bottom and right to left.

The PET keyboard can be converted to Hebrew.

Micro Technology's graphics subroutines occupy about 1K in RAM, which leaves enough memory for any of the main programs which I've tried so far. Even the satellite tracking program with its world map, written by my friend Bill Crowell, just fits into the remaining 7K. However, a complex program, such as a game involving flying air strikes against moving targets over a realistic terrain, would probably require more than the minimum 8K on my PET. Additional memory is easily accommodated by the VM—just remember the address jumpers.

So far, the discussion has been about generating graphics on the monitor screen. A high resolution printout would be valuable for computer art or in computer-assisted design. Bill Crowell has written a machine language program which allows such a printout on a standard Commodore printer and is adaptable to any other printer which offers a user-defined character. Printing is slow, but the results shown in Figures 5 and 6, are effective.

In a future article, Bill and I will talk more about the high resolution printout routine, the programming of three-dimensional graphics, the satellite tracking software, and other graphics programs.

Price

The price of the memory board is $359 with the manual included. The connector board for the PET 2001 is $35; the board for the 16/32K or CBM PET is $65. Internal mounting brackets, if desired, are $15 for the 2001 or $10 for other PETs.

A newly designed VM unit for the 80-column PET, which includes memory board, connector board and internal mounting brackets, is available for $495.

MTU also produces graphics software packages. The basic package containing machine language subroutines for rapid plotting is the one described here. It requires 2K of PET memory and costs $25. A more advanced graphics software package which adds more than 45 graphic commands to the PET Basic and provides a high level of sophisticated graphics programming costs $49. It requires 7.5K of PET memory and is available for all PET ROMs and the 80-column PET.

As I said in the beginning, it's an exciting new world. □

CIRCLE 313 ON READER SERVICE CARD

Color Graphics for S-100 Computers

David S. Repsher

S-100 bus users, take heart. At long last there is a low-priced, high-resolution color graphics board available for your computer. It is your reward for years of patience.

I had wanted color graphics capability for my Imsai since assembling it in 1976, but I resisted the low-resolution, high priced Cromemco Dazzler. I was envious when the Apple and its imitators appeared on the market.

S-100 users were faced with a price barrier that seemed impenetrable. Some devices had high-resolution capabilities that only NASA could fully exploit. All had price tags that only NASA could afford.

Enter Quest. In an unobtrusive corner of an ad that appears regularly in the pages of this magazine, they offered a color graphics board. If it were any good, I figured, it would be highly touted. But for $99, I decided to take a chance.

For that $99, Quest Electronics (P.O. Box 4430X, Santa Clara, CA 95054) will sell you the Super Color S-100 Video kit. This includes 1K of 2114 static memory — enough to do low-resolution graphics. On-board memory is expandable to 6K with the addition of 10 more 2114 chips with sockets, and two 7805 voltage regulator chips. These may be purchased from Quest or any other parts supplier to give the board a resolution capability of 256H x 192V. Total cost of a 6K color board is less than $200 — remarkable.

Hardware Considerations

Although the board utilizes just 6K of RAM, it occupies an 8K block of memory (dip switch selectable to any 8K boundary). Another option allows a 2758 or 2716 of ROM to occupy the top 2K of the address space of the board. It is only necessary to purchase the ROM and socket to implement this option. Another option allows for on-board RF modulation of the video signal. Quest makes the necessary parts available for $2.50 but advises that it does not advocate violation of any FCC regulations which their use may entail.

Thus, the board may be assembled to produce an RF modulated output to the tuner of a TV or a composite video output to a monitor or external modulator. There are also construction variations depending on whether the board will operate in an 8080/Z80 or an 1802 environment.

I had wanted color graphics capability for my Imsai since assembling it in 1976.

The documentation accompanying the board consists of a bound volume, the first part of which provides assembly instructions for the board and options. These instructions are clear and precise, and assembly presented no problems.

The board itself is clean and well laid out. Its uncluttered appearance reflects both the superior design engineering of Quest and the power of a pair of marvelous chips, the Motorola MC6847 Video Display Generator and the MC1372 Video Modulator.

What The Board Will Do

Because the Radio Shack Color Computer uses the Motorola chip set, a trip to the local Radio Shack will provide a demonstration of the capabilities of the Super Color board. However, if the Color Computer is only a 4K model, only the lower resolutions can be observed.

The various graphics modes available with the Super Color board along with the memory requirements of each are summarized in Table 1. It will be noted that eight colors are available only in the lowest resolution mode (64 x 32). The colors are red, green, yellow, blue, cyan, magenta, orange, and buff.

In this mode, alphanumeric characters may be intermixed with graphic blocks on a character-by-character basis (each character position is divided into 2 x 2 blocks). The characters are formed by a character generator on the MC6847 chip.

Those modes which display four colors offer the choice of red, green, yellow and blue or buff, cyan, magenta and orange. The two-color modes display buff and black or green and black.

Mode and color group selection is made by writing into one memory address on the board. However, this location, the highest address on the board, is not in RAM. Rather, it accesses a 74LS374 8-bit register.

The outputs of this chip control the mode select inputs of the MC6847 chip. Thus, if the board occupies memory locations E000H to FFFFH, then writing to location FFFFH would select the various display modes. Location FFFFH could not be read since it is not in memory.

David S. Repsher, 1915 Verde Street, Bakersfield, CA 93304.

Display Mode	Resolution (H x V)	Number of Colors	Memory Required
Semi-4	64 x 32	8	½K
Semi-6	64 x 48	4	½K
One-C	64 x 64	4	1K
One-R	128 x 64	2	1K
Two-C	128 x 64	4	2K
Two-R	128 x 96	2	2K
Three-C	128 x 96	4	3K
Three-R	128 x 192	2	3K
Six-C	128 x 192	4	6K
Six-R	256 x 192	2	6K

Table 1. The various display modes available with the Super Color board and up to 6K of memory. Note that, for a given amount of memory, resolution may be traded off for more colors.

Locations E000H to F7FFH would then be display RAM. Locations F800H to FFFEH would be the space for the optional ROM.

Criticisms

Having operated the Super Color board for over a month, I have no complaints concerning its performance. In fact, my only criticisms concern the area of documentation.

While the construction manual was lucid, instructions for using the board can best be described as adequate. That is, the necessary information is there but it is difficult to piece together the big picture of just what is happening from what is essentially a collection of tables. I speak as one who has assembled and operated at least 20 S-100 boards and mastered the mysteries of CP/M. However, once the literature is muddled through, the board really is simple to operate.

Nowhere in the manual or Quest's ads is there any mention of the on-board ROM. I suppose a graphics driver routine could occupy this space but a letter to Quest asking for present or future plans for the ROM drew no response.

Neither is there any mention in their catalog or ad concerning the on-board RF modulator. One is only advised of this option in the literature accompanying the board. Then if one desires to implement this option (I did), completion of the board must await the arrival of the parts (about a week).

The most serious deficiency lies in the area of software. The manual includes a software listing in 1802 code for a video editor and listings in 1802 and CP/M-compatible 8080 code for driver routines. All of this code makes use of the alphanumeric capabilities of the color board, such as they are.

Few people will buy this board for its alphanumeric capabilities. A 32 x 16 display is of limited utility. Besides, a 64 x 16 board can be purchased for less than the color board.

This board will be purchased by those seeking a low cost, high quality, high-resolution color graphics board. And if it also has a limited alphanumeric capability, so much the better. Yet, Quest did not see fit to include even one line of code exploiting the graphics capabilities of the board. No demo. No driver routines. And this deficiency is made all the more ironic by the inclusion of the alpha driver routines. A letter to Quest on this matter again elicited no response.

Programming Considerations

Fortunately, programming the board is not difficult. The screen is memory mapped; the lowest memory location of the board corresponds to the upper left corner of the screen. Each successive memory location then corresponds to adjacent horizontal screen positions until the 32nd location. The next memory location displays at the left side of the next line. The number of lines, as well as the number of horizontal pixels controlled by each memory location, is a function of the resolution mode being used.

Again, mode selection is made by writing a byte to the highest (pseudo-) memory location on the board. The board can thus easily be used from Basic using PEEK and POKE statements. Of course, any memory location may also be read. The mode select byte, however, since it is not truly in memory, cannot be read. It can be considered a form of read-only memory.

A Sample Program

The program which follows will allow one to draw on the screen of a color TV using the cursor controls of the keyboard to position a blinking cursor. The program uses the highest resolution mode allowing four colors (128 x 196). The user is prompted on his terminal as to which group of four colors to use.

There is also the option of clearing the screen or not. If the screen is to be cleared, it may be cleared to any of the available four colors.

If one wishes to save the screen on disk, typing an S will transfer the screen memory to lower memory. It is there appended to a loader routine and the user is advised how to save the results as a CP/M .COM file.

```
                ;;;
```

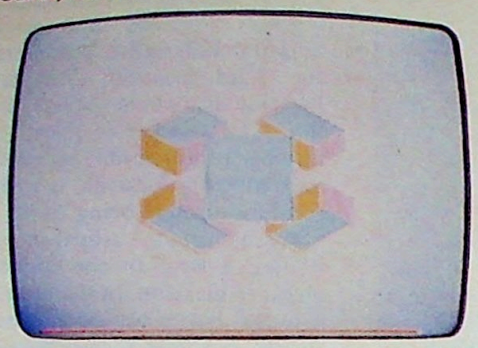


Photo 2A. Demo of graphics capabilities.

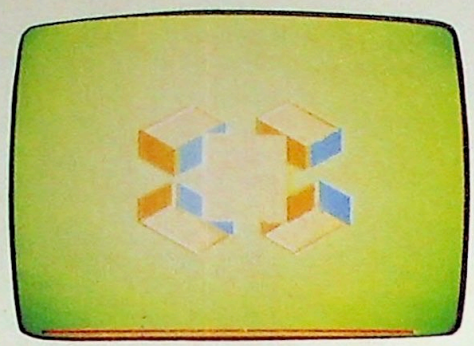
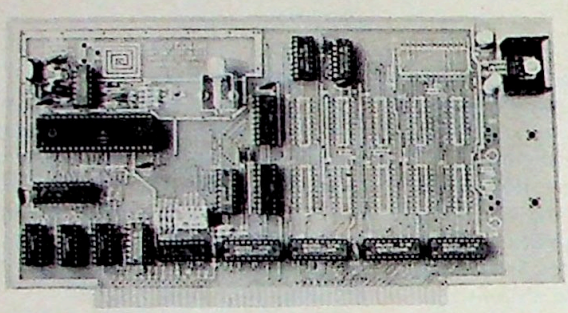


Photo 2B. Same as 2A but using different color group.



The Quest super color board.

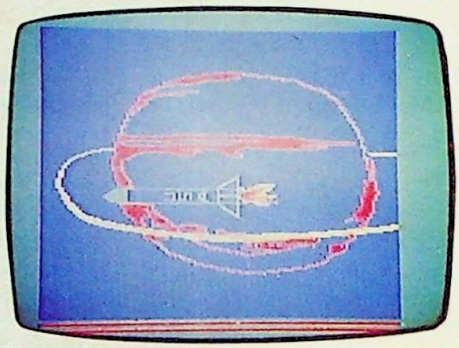


Photo 2C. Changing one bit in control byte...(to 2D)

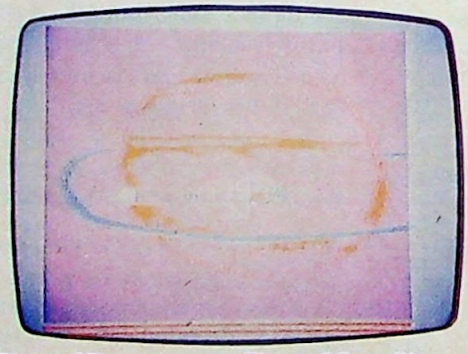


Photo 2D. ...changes Photo 2C to Photo 2D.

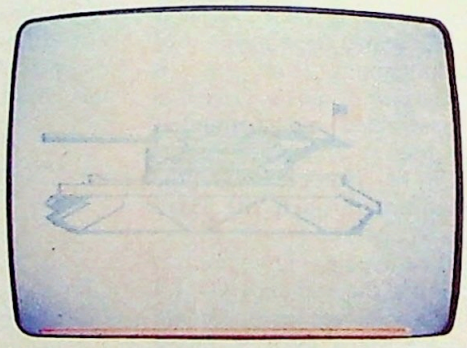


Photo 2E. Poor camera work diminishes display quality.

Bit Pit

Chas Andres

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..COMMANDING A SOFTWARE INVASION ON THE JAPANESE!
GLORGE, WHICH JOB OFFERS FULL COUNTRY CLUB PRIVILEGES AND HELICOPTER FLIGHTS?
BOTH DO - BUT I'M HOLDING OUT FOR 6 WEEKS PAID SABBATICAL AFTER A YEAR!
...MUST BE SUPPLY-SIDE ECONOMISTS...
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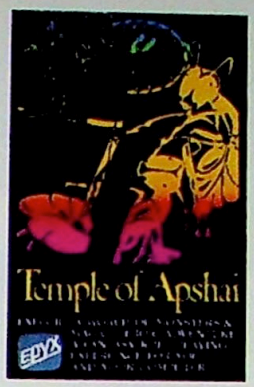
Slaying Monsters Should Be Mostly Fun and Games



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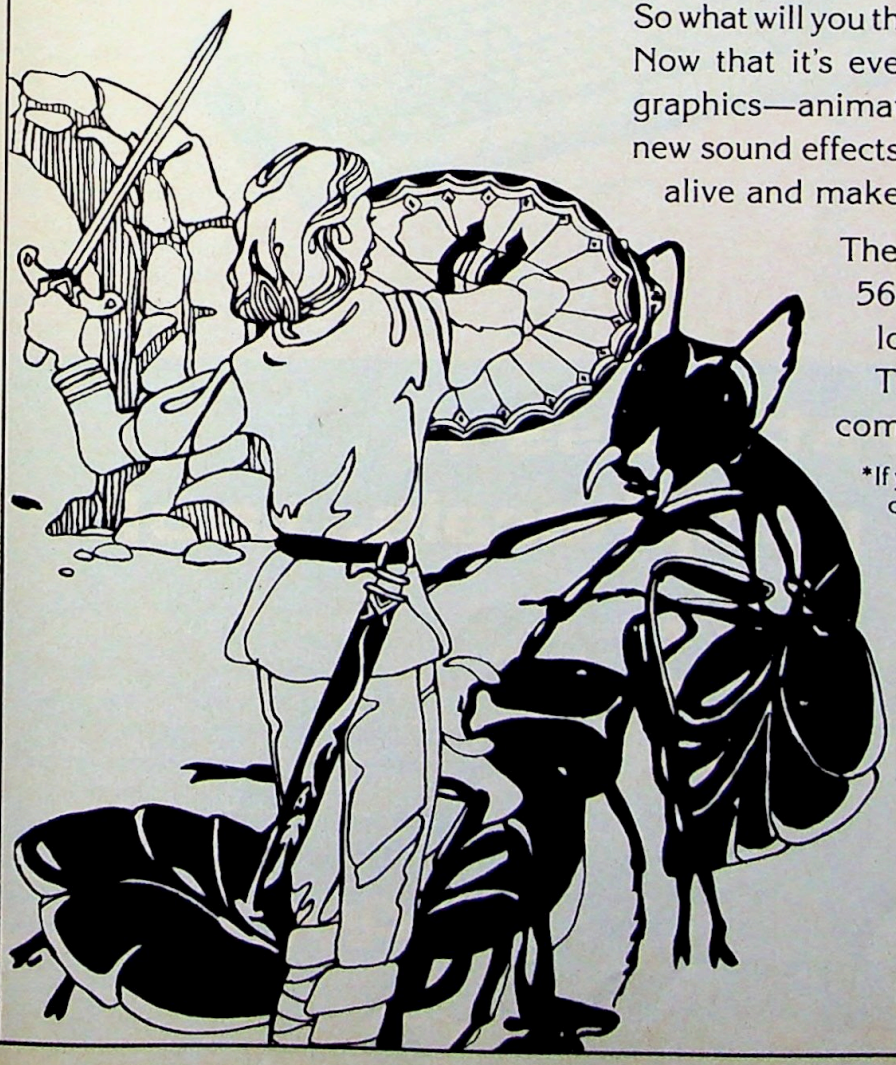

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Then, to display the picture at any time, one merely types the name of the picture. CP/M then loads the picture and reboots, and the Display program may be loaded. When asked whether the screen should be cleared, the user replies NO and may then continue the picture. This process may be repeated until the picture is done.

Typing a number from one to four will change the color of the cursor. To erase, the background color is selected. Then as the blinking cursor is moved, the other three colors are erased. Choosing color 0 will result in a transparent cursor. This is useful when several areas of different colors must be crossed, since the screen is not changed by the cursor. Typing C offers one the opportunity to change color grouping and to erase the screen.

Program Modification

The program was assembled at location 100H to run under CP/M. My own Super Color board occupies memory locations E000H to FFFFH. If the user's board is addressed at a different location, VIDBAS must be changed to reflect this.

DISEND must also be changed. DISEND is the page location of the board plus 18H. For example, if the board is located at page 50H (occupying locations 5000H thru 6FFFH), then DISEND is 50H+18H=68H. This is the end of the RAM space on the board.

Of course, CONST, CONIN, and CONOT must also be changed to call the user's own BIOS, and the ETX may need changing to reflect the REBOOT character of the user's console. The same may be true of the cursor control characters. The commented assembly listing for the program should serve to explain how it works as well as to point out other areas for possible change or enhancement.

Summary

The Quest Electronics Super Color S-100 board is an excellent piece of hardware. It is easy to program, requiring no complex decoding algorithm. The board performs flawlessly, permitting highly detailed screen graphics on an unmodified TV. It is in the area of software, however, that support is needed. I hope that more potential users of this board will stumble onto Quest's advertisement or this article. Then perhaps a software base or users' group may be created. At the very least, a market will be formed that would make it profitable for the talented pros to enter. Some of the fantastic software that is already out there for the appliance computers might also be translated for use by the board.

All of the fantastic potential which is the Super Color Board can only be exploited with imaginative software. It has been said, "software makes hardware happen." □

```
                ;*****************************************************
                ; THIS ROUTINE WILL NOT BE USED UNLESS A SCREEN IS
                ; STORED. IT WILL GO ON THE DISK AND DISPLAY THE
                ; SCREEN WHEN RELOADED AS A COM FILE.
                ;*****************************************************
0100 C31D01             JMP     START   ;THIS INST WILL BE DESTROYED
0103 2100E0             LXI     H,VIDBAS ;POINT TO SCREEN AREA
0106 110003             LXI     D,300H  ;MOVE PICTURE FROM HERE
0109 1A         X1      LDAX    D       ;GET A BYTE OF PICTURE
010A 77                 MOV     M,A     ;STORE IT IN SCREEN AREA
010B 23                 INX     H
010C 13                 INX     D
010D 7A                 MOV     A,D     ;SEE IF DONE
010E FE1B               CPI     1BH
0110 C20901             JNZ     X1      ;NO, KEEP GOING
0113 3A1C01             LDA     MODE    ;DONE. NOW GET DISPLAY MODE
0116 32FFFF             STA     VIDTOP  ;STASH IT IN MODE CONT BYTE
0119 C30000             JMP     0       ;ALL DONE, REBOOT
011C 00         MODE    DB      0       ;RESERVED FOR MODE STORE
                ;*****************************************************
                ;       PROGRAM STARTS HERE
                ;*****************************************************
011D 21C102     START   LXI     H,MSG1  ;POINT TO COLOR SELECT MSG
0120 CD8102             CALL    PRINT   ;OUTPUT IT
0123 CD09C0             CALL    CONIN   ;GET A KEYBOARD CHAR.
0126 4F                 MOV     C,A
0127 CD0CC0             CALL    CONOT   ;ECHO IT
012A 79                 MOV     A,C
012B FE41               CPI     41H     ;IS IT AN ASCII A?
012D C23B01             JNZ     START2  ;NO, MUST BE A B
0130 3E2C               MVI     A,2CH   ;YES, SELECT MODE A
0132 32FFFF             STA     VIDTOP  ;TO MODE CONTROL
0135 321C01             STA     MODE    ;TO MODE STORE
0138 C34301             JMP     START3  ;GO ON
013B 3E2D       START2  MVI     A,2DH   ;SELECT MODE B
013D 32FFFF             STA     VIDTOP  ;TO MODE CONTROL
0140 321C01             STA     MODE    ;TO MODE STORE
0143 219A02     START3  LXI     H,MSG0  ;POINT TO 'CLEAR?' MESSAGE
0146 CD8102             CALL    PRINT   ;OUTPUT IT
0149 CD09C0             CALL    CONIN   ;GET KEYBOARD RESPONSE
014C 4F                 MOV     C,A     ;PUT IT IN C REG.
014D CD0CC0             CALL    CONOT   ;ECHO IT
0150 79                 MOV     A,C     ;PUT IT BACK IN A
0151 FE4E               CPI     'N'     ;CLEAR SCREEN?
0153 CA8101             JZ      C1      ;NO, SKIP IT
                ;*****************************************************
                ;       CLEAR BACKGROUND TO SELECTED COLOR
                ;*****************************************************
0156 215003             LXI     H,MSG2  ;BACKGROUND SELECT MSG
0159 CD8102             CALL    PRINT
015C CD09C0             CALL    CONIN   ;GET A VALUE FROM ASCII 1 TO 4
015F 4F                 MOV     C,A
0160 CD0CC0             CALL    CONOT   ;ECHO IT
0163 79                 MOV     A,C
0164 3D                 DCR     A       ;MAKE A VALUE FROM 0 TO 3H
0165 E603               ANI     3       ;STRIP OFF ASCII PART
0167 47                 MOV     B,A     ;BKGD COLOR IN B
0168 4F                 MOV     C,A     ;SAVE IT IN C TOO
0169 07                 RLC             ;MAKE ONE 8 BIT BYTE
016A 07                 RLC             ;OUT OF FOUR 2 BIT CODES
016B B0                 ORA     B
016C 07                 RLC
016D 07                 RLC
016E B0                 ORA     B
016F 07                 RLC
0170 07                 RLC
0171 B0                 ORA     B
0172 47                 MOV     B,A     ;DONE, SAVE IT IN B
0173 2100E0             LXI     H,VIDBAS ;POINT TO VIDEO BASE
0176 70         CLEAR   MOV     M,B     ;PAINT BACKGROUND
0177 23                 INX     H
0178 7C                 MOV     A,H
0179 FEF8               CPI     DISEND
017B C27601             JNZ     CLEAR
017E 78                 MOV     A,B     ;BACKGROUND BYTE TO A
017F 41                 MOV     B,C     ;INITIAL COLOR MASK TO THE B
0180 4F                 MOV     C,A     ;BACKGROUND BYTE TO C
0181 2114EC     C1      LXI     H,VIDMID ;POINT TO MID SCREEN
0184 229602             SHLD    ADSTR   ;STORE ADDRESS
                ;*****************************************************
                ;       PROGRAM SITS HERE BLINKING THE CURSOR
                ;       WAITING FOR A KEYBOARD COMMAND
                ;*****************************************************
0187 2A9602     BLINK   LHLD    ADSTR   ;POINT TO CURRENT SCRN POS
018A 78                 MOV     A,B     ;PUT CURRENT MASK IN A
018B A9                 XRA     C       ;COMPLIMENT 2 BITS TO BLINK
018C 77                 MOV     M,A     ;DISPLAY IT
018D CD8C02             CALL    DELAY   ;KILL TIME
0190 79                 MOV     A,C     ;RESTORE ORIGINAL DATA
0191 77                 MOV     M,A     ;DISPLAY IT
```

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Color Board, continued...

```
0231 3A9802    LEFT    LDA     PNTR    ;GET 1 OF 4 CHAR PNTR
0234 B7                ORA     A       ;SEE IF IT IS LEFTMOST POS
0235 C23F02            JNZ     L1      ;NO
0238 2A9602            LHLD    ADSTR   ;YES, SO GOTO NEXT CHAR
023B 2B                DCX     H       ;MOVE LEFT 1 CHAR
023C 229602            SHLD    ADSTR   ;SAVE NEW ADDR.
023F 3D        L1      DCR     A       ;DOWN COUNT POINTER
0240 E603              ANI     3       ;MASK OFF 6 MSBITS
0242 329802            STA     PNTR    ;STORE NEW POINTER
0245 C35B02            JMP     PLOT    ;GO MOVE THE CURSOR
               ;
0248 219802    RIGHT   LXI     H,PNTR  ;GET CHAR. POS. PNTR.
024B 7E                MOV     A,M

024C 3C                INR     A       ;INCREMENT 1 TO RIGHT
024D E603              ANI     3       ;MASK OFF 6 MSBITS
024F 77                MOV     M,A     ;STORE NEW POINTER
0250 B7                ORA     A       ;SEE IF INC TO NEXT POS
0251 C25B02            JNZ     PLOT    ;NO, DISPLAY IT
0254 2A9602            LHLD    ADSTR   ;YES, GET OLD ADDRESS
0257 23                INX     H       ;POINT NEXT POSITION
0258 229602            SHLD    ADSTR   ;NOW DROP DOWN AND DISPLAY IT
               ;;;
```

```
0192 CD8002             CALL    DELAY   ;KILL TIME
0195 CD06C0             CALL    CONST   ;KEYBOARD INPUT?
0198 C49E01             CNZ     READ    ;IF SO, GET IT
019B C38701             JMP     BLINK   ;IF NOT, KEEP BLINKING
                ;;;
```

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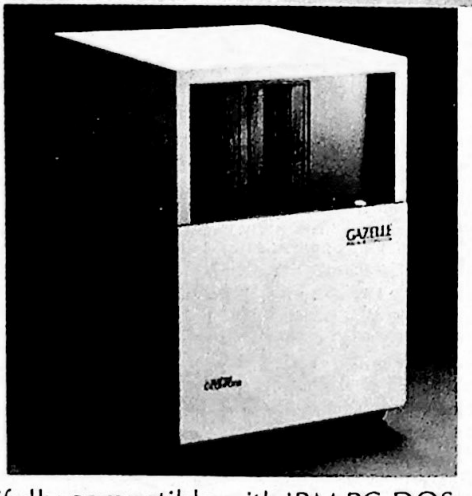

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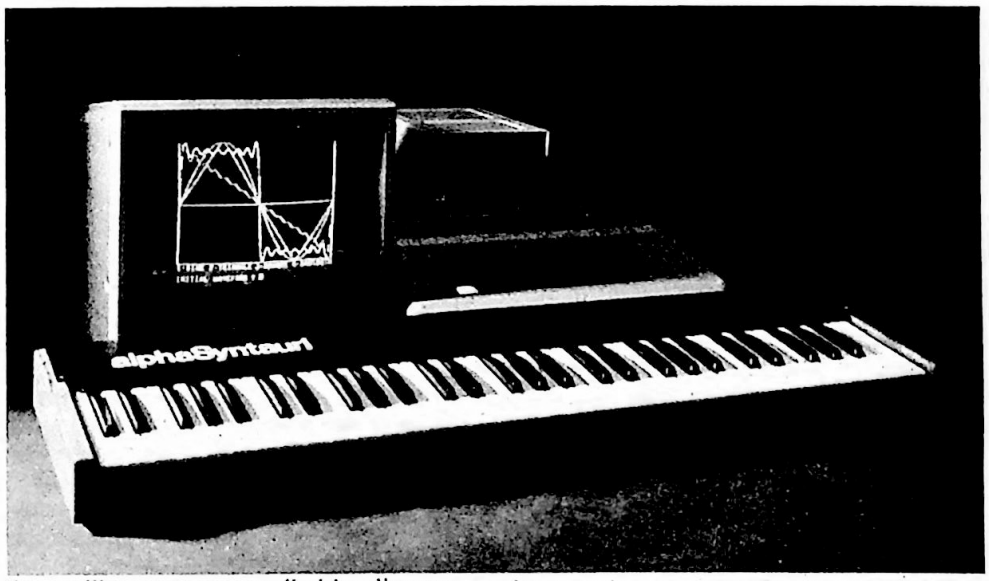
Making Apple Music

Mario J. Acerra

The alphaSyntauri Instrument System is a digital, polyphonic music synthesizer and keyboard which interfaces with the Apple II computer. I have been using the system for about a year and a half, and have seen it develop and expand.

I am by trade an instructor of media technology and criticism but have a diverse background in music and theater. I work as an independent film/video maker and have scored numerous films with the system. I have done some session work on albums with the alphaSyntauri synthesizer and have played it live in concert and with theatrical revues.



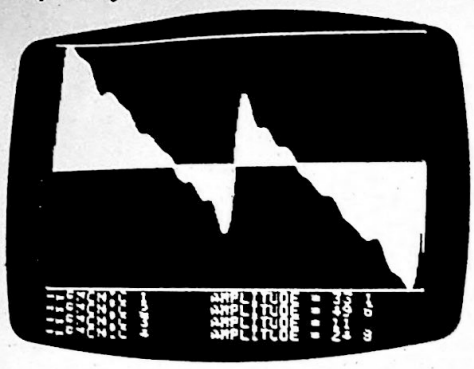
Analog and Digital

I have composed and recorded electronic music for about ten years and, like most musicians, I worked with analog equipment. The transition from analog to digital can be a little confusing from the musician's standpoint so a few words are in order. All sound is ultimately analog but it is the means by which the sound is created that can be described as either analog or digital. Synthesizer music is produced by oscillators. In an analog system the oscillator is controlled by voltages. Various control voltages produce different pitches. In a digital system the oscillators are controlled by discrete numbers. There is, however, another difference between analog and digital systems such as the alphaSyntauri synthesizer and that is in the type of synthesis that occurs.

An oscillator is capable of producing the sounds of different types of waveforms and these waveforms are one of the determining factors governing the timbre or color of the tones produced (i.e. whether a sound is more brass-like, string-like, or bell-like). Popular analog synthesizers use "subtractive synthesis" to produce various waves. That means that a fairly rich, complex wave is fed through a filter which subtracts certain frequencies until the desired sound is obtained. Most synthesizers of this type have three or four standard waves to choose from: the classic sawtooth, pulse, and triangle or sine wave.

Digital systems build from the ground up, adding harmonics to simple waves until the desired sound is obtained. This allows for more exact control of the waveform and a greater diversity of waves from which to choose. It is, of course,

Mario J. Acerra, 511 Lechauweki Ave., Bethlehem, PA 18015.



DRAW WAVE.

possible to produce sawtooth, pulse and sine waves digitally, but you can also produce all kinds of combinations and variations.

There are some advantages to analog systems. Certain effects and sounds such as filter sweeps, white noise and portamento seem easier to produce on analog systems. With analog systems you can experiment and otherwise fiddle innocently with various filter settings and arrive at interesting sounds.

Building waves in the digital system demands somewhat more knowledge of harmonics and the nature of sound. You are less likely to create an interesting sound accidentally by fiddling. In other words, you need a sense of what kind of sound you want before you can create the wave.

Finally, some analog users will argue that analog sound is best produced by analog means. There are, however, several very good reasons to consider digital synthesis.

Once digital techniques are mastered, the precision and variety of sounds are greater with a digital system. A limitless number of sounds can be produced without depending on the rather large chunks that a filter takes out of the sound. Furthermore, digital synthesis eliminates the bane of many an analog synthesist: drifting oscillators and the resultant "out-of-tune" state of the synthesizer.

Digital synthesizers are also far more precise at remembering and reproducing instrument patches. Analog synthesis involves a great deal of knob twisting and wire connecting. It is very tedious and time consuming to reset all of the knobs on an analog synthesizer to an exact setting from a previous session. Digital systems store all of the various sound paramaters as numbers. These settings can be kept in the computer memory or stored on disk. Thus, with the press of a few keys, you can recall a previous patch immediately and exactly.

Finally, as a sequencer, the digital instrument can handle far more information. Most analog instruments can playback or repeat between twenty and forty notes. The alphaSyntauri instrument can handle up to 2000 notes for mono *or* polyphonic sequencing.

Well, in any case I was convinced to convert to digital synthesis. After looking over various systems I chose the alphaSyntauri synthesizer. I was and still am convinced that, within its price range, the system offers a remarkable amount of capability, even compared to popular analog polyphonic instruments.

Hardware

There are two alphaSyntauri keyboard systems. The alphaSyntauri 5 is a five octave (C to C) velocity-sensitive keyboard. The Plus 4 looks similar but has four octaves and no velocity sensitivity. Both keyboards have eight-voice polyphony with two oscillators per voice and stereo output with oscillator offset control in 32nd tones. This results in a very "fat" sound.

The Syntauri system uses the fine oscillator boards produced by Mountain Hardware. These boards are plugged into two slots in the Apple, and a third slot is used for the keyboard interface card. It is also possible to use the ALF card. For this particular application, however, I definitely recommend the Mountain Hardware cards as they more fully exploit the versatility of the keyboard system.

Ten instruments can be kept in memory at a time and called up instantly.

The frequency range of the oscillators is from 27.5 to 16,000 Hz. The quality of the tones produced is good, from deep bass tones to sweet highs. It is possible to produce unsatisfactory or distorted tones by adding certain harmonics, overextending the frequency range of a given wave, or shaping the envelope incorrectly, but a little attention to these details produces very clean tones.

The design approach of Syntauri stresses plug-in hardware modularity and I consider this an advantage. This means that if a new oscillator board with added capabilities is developed, the keyboard does *not* become obsolete. The system lets you use new hardware as it is developed. This can, in effect, give you an entirely new synthesizer without the cost of replacing the entire system. The same situation exists with software updates.

This expandability is a definite advantage over most commercial analog systems and eliminates the familiar agony of seeing your synthesizer become outdated within a few years or even months of purchase.

Velocity sensitivity is achieved in the traditional manner of having two switch contacts for each note. The computer notes the delay time between the first and second contact and appropriately affects attack rate and volume. The degree of the effect can be controlled by the user. The contact wires are a bit delicate and hard to replace but mine have held up pretty well.

The keyboard is sturdy and well built. It is very portable, being less than three inches high. If you plan any extensive travel with the system I recommend the use of Anvil cases. There are not, to my knowledge, any stands yet available so you need a proper set up procedure.

Hardware accessories include foot pedals for sustain and portamento. One drawback in the current system is that portamento is either on or off and the rate cannot be varied. Other sound modification is controlled by the Apple keyboard (or remote keypad) and game paddles.

I would like to see some kind of pitch and mod wheels developed and perhaps foot pedals which plug into the game port of the Apple to perform some functions now handled by the paddles.

Finally, although overall volume can be manipulated via the Apple keyboard, you must take your hands off the instrument keyboard to do so. Thus I have found a volume pedal a good accessory. A standard volume pedal of the sort available in music stores works well. A two-patch cord converts the stereo output to mono to be fed through the pedal, or you can buy a separate pedal for each channel.

Software

Good software is essential for any system and often proves to be the true mark of excellence. This certainly applies to Syntauri. When you buy the alphaSyntauri synthesizer you are not simply buying a keyboard; you are buying a total system. The use of a varied line of software, rather than expensive hard-wired modifications, brings an inexpensive flexibility to the instrument.

Currently available software offers a wide range of capabilities from defining and saving sounds to scoring and teaching.

Research and development of new software is an ongoing process. Within the past year several operating systems have been introduced as well as numerous utilities. A different operating system effectively gives you an entirely new synthesizer. The best part of this arrangement is that new operating systems and utilities are offered to owners at what I

consider extremely reasonable rates. Most are available for about the cost of a good arcade game.

Three operating systems are included with the Alpha 5: the original Alpha III standard system, alphaPlus which has some unique playback capabilities and special effects, and SuperPlus which is designed for live professional playing, and offers features such as split keyboard and sound-on-sound recording and playback. All files, patches or instrument banks created with one system are compatible with all other existing systems and utilities.

Capabilities shared by both keyboards include a wave generating program which allows for the creation and saving of unique wave forms. Hi-res graphics show the shape of the wave and reflect alterations as you add harmonics. A reference tone is produced so that you can hear changes as they are made.

Each of the two oscillators assigned to each note can have a separate waveform and each oscillator has its own envelope. The envelope affects such parameters as whether a sound will slowly build, ring out, hold indefinitely or have a percussive quality.

Envelopes are the familiar ADSR type. They control the attack rate and volume, decay rate, sustain rate, and release rate and volume of each note. The user can specify values for all these parameters within a range of 0 to 255. Each waveform is also composed of 256 definable points.

The combination of two waveforms and envelopes creates a completed "instrument." Ten instruments can be kept in memory at a time and called up instantly. Up to 200 may be stored on a single diskette.

Using two separate oscillators per note with separate wave forms and envelopes allows the sound of each note played to change over time. This is similar to the analog process of sending a filter through an ADSR envelope as each note is depressed. Unlimited instruments can be created, but over 50 come already developed for you if you don't want to get into instrument creation immediately. These include very nice strings, decent brass, superb Hammond B-3 and pipe organs, good Rhodes and vibes, and just about everything else from funky "fat" instruments to far out electronic sounds.

A very nice software feature is the ability to transpose what you are playing into any key. Steps are in quarter tones. I found this especially handy when working with vocalists who may want to try a song in various keys.

Vibrato and tremolo are available as well as pitch bend, pitch sweep, and timbre scan in the effects mode. Timbre scan is particularly interesting in its capacity for constantly changing tone colors. The value of some of the other effects is dependent on finding just the right settings for them (via game paddles).

In the recording mode you simply play any note sequence (mono or poly) of up to 2000 notes and the Alpha will play the sequence back exactly as you have entered it, including rests and dynamics. You can playback just once or in a continuous loop for sequencer effects, and you can play on top of recordings or sequences during playback. It was difficult to achieve smooth sequencer loops and to play along with recordings in the earlier operating systems, but this has been rectified in SuperPlus. Here, playback speed is variable from 1 to 800% and you can save any note file to disk with up to 20,000 notes on a single diskette.

During live playing or recorded playback the Apple monitor displays current instrument parameters and also displays flickering bars or squares of color which correspond to each note being played.

There is a very exciting software package due out soon which will digitally convert any piece of music played on the alphaSyntauri into hi-res graphic musical notation.

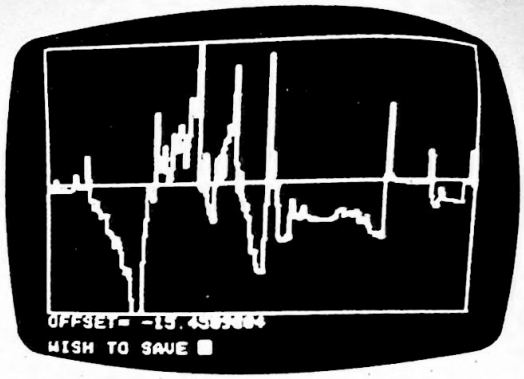
While I have never found a real need for this latter display I suppose it could be fun at parties.

In addition to all of the above, the alphaSyntauri 5 synthesizer has some special software generated capabilities. The split keyboard feature allows up to eight separate instruments with user-defined split points. This is fantastic for things like chording on one end and lead sound on the other.

In the recording mode you have sound-on-sound capabilities with up to eight different instruments simultaneously. You can keep on adding tracks on top of tracks until you reach the memory capacity.

Both keyboards can take advantage of several utility programs created by Steve Leonard. For those new wave aficionados, Steve is the keyboard player for The Cretones and his utilities are very "musician" oriented.

Draw Wave allows you to draw wave forms on the Apple monitor and save them for later use. You can use the game paddles for this and it is easier than



From DRAW WAVE.

specifying harmonics. The program gives digital users some of the experimentation capabilities available to analog dial twisters. I have found that you can sometimes just draw an interesting looking waveform and find that it sounds good too. While this is certainly not always the case, with a little practice you can get pretty good at it.

Auto Pulse allows you to make precise representations of pulse waves with duty cycles between 0 and 50% with a user defined number of harmonics. Pulse waves are a common sound source in electronic music and this software pack makes it very easy to create various types.

B-3 Wave Maker duplicates just about any setting on a Hammond B-3 organ. You can specify each "drawbar" setting and the result is almost indistinguishable from a real Hammond, except of course that the Hammond weighs several tons while the alphaSyntauri synthesizer is very lightweight.

Applications

When playing live, I have found that using my alphaSyntauri synthesizer eliminates the need for carrying around half a dozen keyboards to get various sounds. Most commercial keyboard sounds plus many more can be stored on disk and called up when needed.

The instrument sounds good live and holds up well, although you must be careful to ground the Apple AC plug and watch for power spikes or interference from light dimmers. Also, on hot stages you must be sure that the Apple does not overheat. I recommend the use of a heavy duty fan for cooling the Apple.

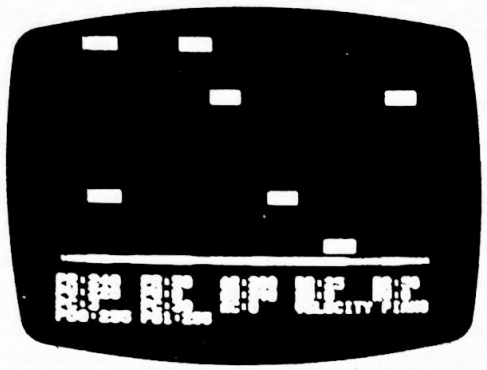
For use in a theatrical setting the alphaSytauri instrument adds a big dimension to a small ensemble. In the recording studio I have found it useful for creating fully orchestrated sounds. With hundreds of sounds to choose from, you can bring versatility to session work and with multi-track recording either at home or in the studio you can achieve very complete, professional recordings. I have scored several film/video works solely with the alphaSyntauri synthesizer.

alphaSyntauri, continued...

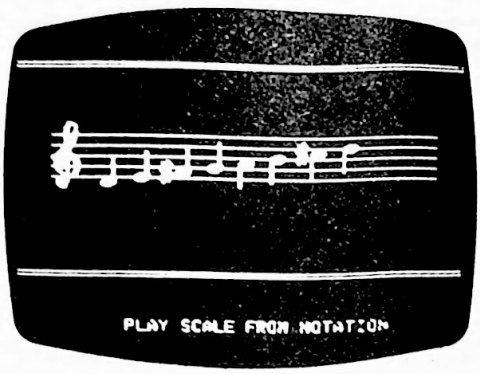
Along with the Syntauri system, I often use a Roland drum computer for percussion and I feel it is a useful addition. The synthesizer, by the way, can send a signal out of the Apple cassette port to trigger drum machines. Since there are some sounds more readily achieved with monophonic, analog instruments, I keep a Sequential Circuits Pro-One around. Actually, there is no reason why further software modifications to the Syntauri system might eventually make this unnecessary. One thing I would like to see is the ability to use more than two oscillators per note on a given voice.

There is a very exciting software package due out soon which will digitally convert any piece of music played on the alphaSyntauri into hi-res graphic musical notation. You can then dump to a graphics printer. This is a marvelous package for musicians that will eliminate the very tedious work of transcribing. You simply play the song and the system prints it out for you.

The sheet music I have seen looks very professional. It is fully polyphonic and prints out automatically in score format with text editing capabilities for lyrics or chords. Variable key signatures, rests, accidentals, measure tie marking and variable time signatures are all supported.



Monitor display listing envelope settings and color blocks during live play.



From CAI program.

Finally, I should mention one more application: music education. Syntauri offers an excellent CAI program for music theory and ear training. *MusicMaster* was developed by Drs. Wolfgang Kuhn and Paul Lorton, pioneers in the use of computers in music education. Briefly described it is an interactive teaching aid for learning musical basics such as intervals, scales and melodic dictation. It is organized in modules with student record keeping, performance analysis, and a teacher management system.

Conclusion

Are there synthesizer systems that are better than the alphaSyntauri Instrument System? Yes, but they cost three to ten times the price of the Syntauri. The alphaSyntauri synthesizer is close in quality and certainly in capabilities to these higher priced systems and, when you consider the price, it is a very worthwhile system.

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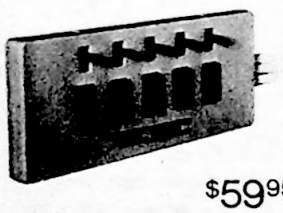

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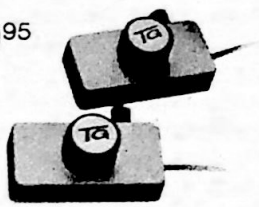

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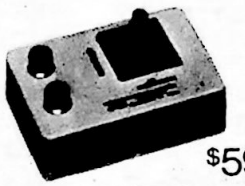

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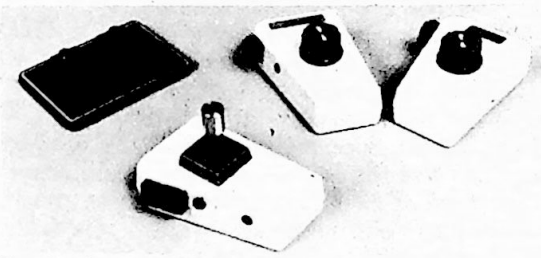

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16-Track Recording System

By the time this review is published there will be a 16-track digital recording system available for the alphaSyntauri. Metatrak is a true multi-track system in that each track is isolated from the others and can be recorded over or changed independently.

Features include per track independent control over volume, instrument selection and vibrato. After recording, pieces may be mixed and remixed with new timbres and tracks any number of times. Any of the ten instruments in memory may be assigned to any of 16 tracks and it is possible for two or more instruments to play the same notes simultaneously. A built-in click track provides multiple outputs and control at 1 to 280 beats per minute.

Because the alphaSyntauri implements recording digitally, Metatrak provides features and capabilities not possible on conventional tape based systems. Such features include absolutely no S/N ratio degradation, the ability to change instruments on already recorded pieces, the ability to change playback speed without pitch change, and special sequence recording modes.

Future additions to the system include punch in/punch out, fast forward, velocity recording and an expansion kit that would increase recording storage to 20,000 notes (about half an hour of music).

Metatrak is available as part of a total system or as an add on to the alphaSyntauri 5 synthesizer. It is more expensive than other software updates (about $250) but it is worth the price.—*MJA*

At $1795 the alphaSyntauri 5 is an excellent choice for demanding professional use. (Both of these prices include the Mountain Hardware oscillator cards.) Even when you add the price of an Apple II computer, disk drive and language or 16K RAM card (all are necessary to run the synthesizer), the entire system is still very cost effective and superior in versatility to commercially available analog systems in that price range and even comparable to the much more expensive systems.

The documentation is very complete and contains a decent tutorial that even a novice can follow. Inexpensive software packages and hardware modularity ensure a system that will not become obsolete but will allow an affordable state-of-the-art system.

My musician friends are generally amazed at the capabilities of the system, although one of them recently remarked that it was the first time he had seen someone show up for a gig with a computer terminal. I'm sure we'll be seeing many musicans doing just that in the very near future.

Syntauri Corporation, 3506 Waverly St., P.O. Box 50578, Palo Alto, CA 94306.

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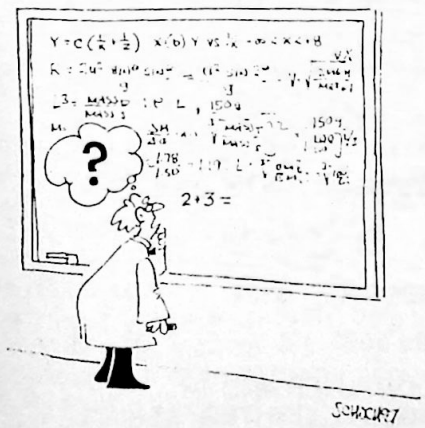

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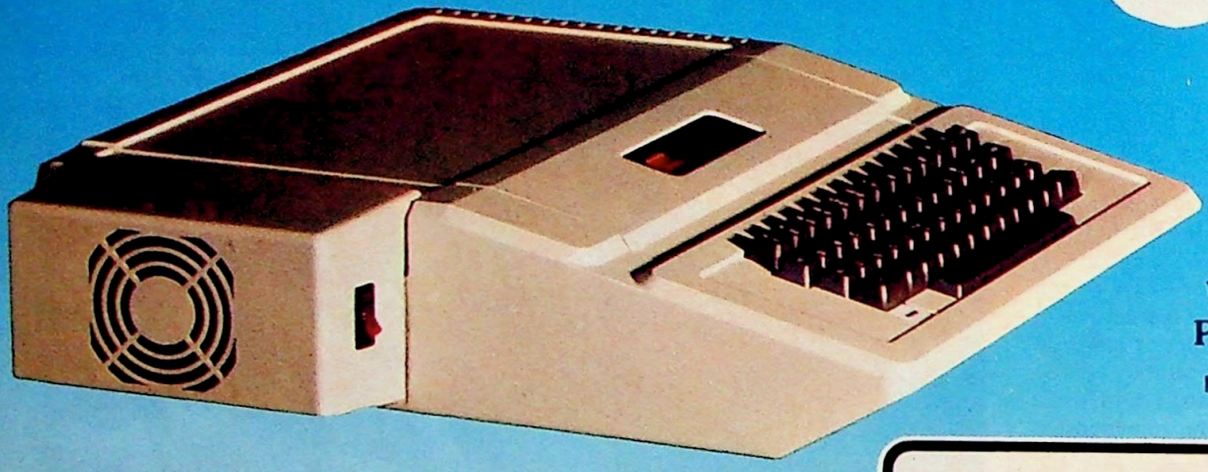

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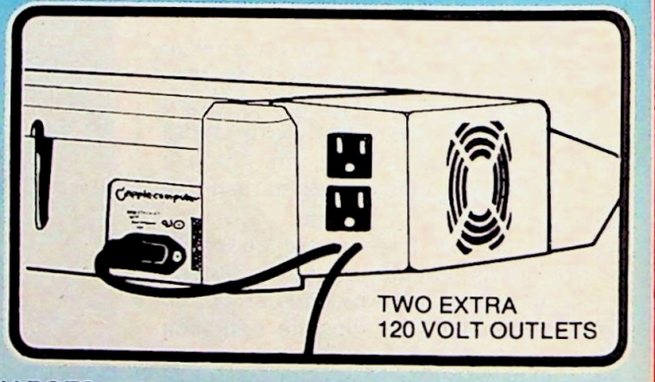

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For Apple and Atari

Joysticks, Paddles and Game Port Extenders

David H. Ahl

Blisters and Frustration

Do you find yourself putting off a game of *Super Invaders* or *Sneakers* because of the too-small button on the Apple Paddle controller? Did you buy *ABM* or *Red Alert*, only to find them too frustrating to play without a joystick? Do you find *Snack Attack* or *Jaw Breaker* impossible to play from the keyboard?

Increasingly, with the sophisticated game designs appearing on the market and with more and more designers copying the popular arcade games, it is next to impossible to enjoy these games without a good set of paddles and joystick controls.

In this pair of reviews, we examine many of the popular paddle and joystick controls now available for the Apple computer. We also look at some ancillary accessories which make these controls easier to use.

Paddle Controls

The word paddle is a misnomer. The rotary control called a paddle is actually a variable resistor, which is also (correctly) known as a potentiometer or rheostat. In a sense, the control is the same as a volume control in a radio except that the resistance varies in a linear fashion from the beginning to the end of rotation in a computer control where as it follows an "S" curve in most audio devices.

The reason this control is called a "paddle" in the personal computer industry is that it originally got its name from the control which moved the paddles on the screen in the game of Pong. This was followed by the game of Breakout and by then the incorrect term, paddle, had taken hold.

In a book that I am working on, an editor changed the word paddle to "knob." This, of course, is equally incorrect. However, since it is unlikely that the computer world is going to grow to love the correct term potentiometer or rheostat, we are stuck with paddle.

Incidentally, it is up to the computer program to translate the resistance value from the paddle into something that can be used in the program. In the Apple, normally one end of the resistance is assigned the value of 0 and the other end 255. However, game designers can achieve much tighter control, i.e., less paddle rotation, by using the value of say 60 as one edge of the screen and 180 as the other.

Good software must also take into account one other factor: paddle and joystick adjustment. Since there seems to be little standardization among manufacturers as to the value of the potentiometer to be used in paddles and joysticks, good software should allow the user to set the joystick or paddle to one extreme and then the other and adjust the program accordingly. Of course, another acceptable approach is to use just a portion of the rotation. The resistance of the potentiometers in the paddles and joysticks we have measured has varied from a low of 70K ohms to a high of 185K ohms. The nominal value "expected" by the Apple computer, incidentally, is 150K.

Controls with higher resistance require less rotation from one side of the screen to the other, thus the control responds more quickly. On the other hand, high-resistance controls are less precise for making fine adjustments needed to hit small targets such as the bonus pine trees in *County Fair*.

Joystick Controls

Joysticks come in two varieties. First is the type found in most coin-op arcade games, the Atari Video Computer System and the like. It has four switches corresponding to the four directions that the joystick may be pushed. Hence, when the joystick is in the center position, all switches are off. If it is pushed squarely to the north, east, south or west, one switch will go on for each direction. An intermediate (diagonal) direction will normally cause two of the switches to close.

In the joysticks used in arcade games, the diagonal directions are sometimes "locked out" by means of nylon adapter plates which permit movement in only four (sometimes only two) directions.

A second type of joystick is one which uses two potentiometers, one for the north/south or Y direction and the other for the east/west or X direction. This type of joystick often does not have automatic centering as the four-switch joysticks usually do. Centering on the ones that have it is usually accomplished by means of small springs which may be removed if the user desires.

In general, a potentiometer-type joystick may be used for all joystick applications whereas a switch-type is useful only for games requiring on-off movement control in two, four or eight directions. However, it is generally easier to use a switch-type joystick for the Pac-Man and Berzerk families of games as it provides more positive control and better centering.

User Features

The motoring magazines sometimes say of a car, "the controls fell naturally to hand." We found that some of these controls felt better in the hand than others. Indeed, some were clearly designed for table top use and did not fall at all naturally to hand. Furthermore, hand sizes are different, so what may be a good hand-held control for an adult male may be overly large for women and children.

Tactile feedback is the positive indication to the user that contact has been made in a control. Two schools of thought exist about tactile feedback both among users and manufacturers. One holds that it is necessary and good. The other holds that it is unnecessary and not cost-justified. I know people who want a positive click

when a firing button is pressed whereas I press buttons forcefully enough that I don't need or want any additional feedback to tell me that I've made contact. Since it is a matter of personal preference, we have simply noted in the chart whether a control has tactile feedback or not.

Game Control Extenders

Ordinary DIP (dual in-line package) sockets are not designed to be used over and over: eventually they won't make contact. Also, repeatedly stressing a 16-pin connector will cause the pins to bend and possibly snap off. Furthermore, continually messing around with the game I/O connector on the back of the Apple motherboard is just not healthy for the motherboard itself.

Hence,if you expect to change back and forth between joysticks and paddles very much, we strongly recommend a game control extender. One type consists of a quick disconnect zero insertion pressure I/O port mounted on the outside of the computer. The device is permanently plugged into the Apple game port inside. Examples of such devices are the EZ Port from Versa Computing or game socket extender from Happ Electronics. Utilizing a ZIP (zero insertion pressure) socket, the user merely plugs in his 16-pin DIP plug and throws a small switch which engages the connection within the socket.

An alternative to a single port extender is a switchable port unit. While more expensive than single extensions, these units allow paddles, joystick, lightpen, VersaWriter or other control devices to remain plugged into the Apple permanently.

We've found it useful to paint the notched end of the DIP connector of various plug-in devices with a small dab of white paint or liquid paper. This marked end corresponds to Pins 1 and 16 which are the up direction on most extension port devices when they are mounted on the right side of the Apple case.

Protect the Connector

We also keep small pieces of styrene around to plug the DIP connectors into when the device is not in use. All too often pins have been broken or bent when a socket was accidentally stepped on or banged by a chair. The white styrene (a packing peanut will do quite nicely) not only protects the plug but is also quite visible if it falls on the floor.

Atari joysticks use an Atari-type DE-9 plug (which is considerably more rugged than a DIP connector. Nevertheless, repeated insertion and removal tend to distort the female receptacles on the joystick cables.

To overcome the connector vulnerability problem, CJM has gone to rugged but more expensive Cinch Jones connectors (see description below).

Test Procedure

Each paddle and joystick was given a thorough workout by all members of our game testing panel. As we've mentioned before, our panel consists of adults and children of both sexes over a wide age range. Thus, products are judged from many different perspectives.

Paddles were tested using the following games: *Torax*, *Tsunami*, *Sneakers* and *County Fair*.

Potentiometer-type joysticks were tested using *Photar*, *ABM*, *Pegasus II*, *Red Alert* and *Twerps*.

Switch-type joysticks were tested with *Thief*, *Snack Attack*, *Jaw Breaker* and *Labyrinth* on the Apple and *Onslaught* and *Star Raiders* on the Atari Personal Computer.

Recommendations

For maximum game playing enjoyment, we recommend the following for the Apple computer.

1) *A set of paddles.* Paddles differed mainly in firing button placement, size, shape, and throw. You should look for one that suits your style of play. In general, left handed players will find fewer suitable paddles than right handed players.

2) *A potentiometer-type joystick.* As with paddles, the main differences among joysticks were in the firing buttons, although, as the individual descriptions indicate, there are other differences as well. We recommend a joystick which is not self-centering or one in which the self-centering can be defeated—preferably outside the case. While trim adjustments are desirable, most joysticks did not have this feature, and those that did were not necessarily the best in other regards. If you do not have or plan to get a switch-type joystick (see number 3), then you should probably get a potentiometer-type joystick with self-centering.

3) Switch-type joystick. The value of this type of joystick for playing Pac-Man, Berzerk and maze games cannot be overstated. It is far superior to a potentiometer-type joystick and you will be astonished at the added enjoyment of playing games using this type of joystick. To use a switch-type joystick with the Apple computer, you will need an adapter of which there are only two on the market—from Astar and Sirius. Naturally, you must have this type of joystick for the Atari Personal Computer and Video Computer System.

4) *Game port extender.* It is a matter of personal preference whether to get a single game port extender with a zero insertion pressure socket or a more elaborate unit with up to six sockets for external devices. While all the extension devices tested had one or more desirable features, no one device had absolutely everything. Our ideal device would be one with four switch selectable, zero insertion pressure DIP sockets, two non-diode isolated sockets, and two switch selectable DE-9 sockets. The device would also have a jumper panel so that one or two of the DIP sockets could be wired to your own specifications.

5) *An external speaker or hi-fi adapter* (see reviews for explanation).

By selecting the cheapest device in each category, a set of these five devices could be put together for as little as $100. However, a more realistic budget would be $180-200. That may sound like a lot, however, the increased enjoyment from playing games with quality controllers and good sound cannot be over-emphasized.

Have fun!

Potentiometer Joysticks

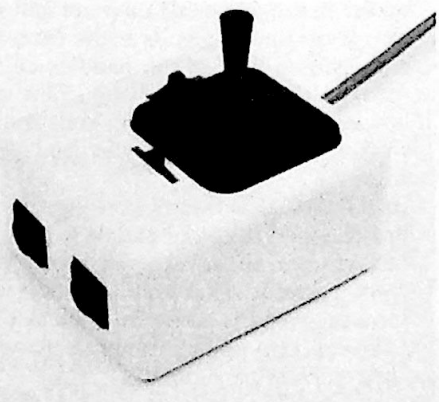
A2D Joystick (2001)

In contrast to other joysticks, the A2D Model 2001 features an open gimbal design usually found only in precision radio controlled model airplane controls. According to the brochure, "this design results in a lighter feel and more precise movement than that available with ball stick assemblies." We found this to be true and, in fact, found that this design allowed us to play games for which we normally recommended a switch-type joystick (Pac-Man, Berzerk, etc.).

The compact size of the Model 2001 permits it to be easily held in one's hand and the placement of the two buttons on the back allows them to be pressed with the index and middle finger of the hand holding the joystick. Unlike some others (and the earlier A2D Model 1002), the Model 2001 does not favor either left or right handed players. We especially liked the buttons on this joystick. They are large (5/8" square), have a very short throw, and provide excellent tactile and aural feedback.

Mechanical trim is provided for each axis, allowing accurate self-centering of the stick.

The control knob on the joystick is relatively small and is held by friction to



the end of a non-threaded shaft. People had mixed feelings about this. Some liked the small size because of the precision "feel" it seemed to impart. Others, however, found the knob occasionally came off in their fingers during particularly violent play of a game. Once aware of this, most players were able to adjust their playing style to compensate.

The Model 2001 comes with an extremely generous 8-1/2' shielded cable. As it is round and not a ribbon connector, it is quite flexible.

In summary, the A2D Model 2001 is an outstanding joystick in practically every respect and it got high marks from all members of our playing panel. Our only minor criticism is the friction-fit knob, but most people will not find this a major drawback.

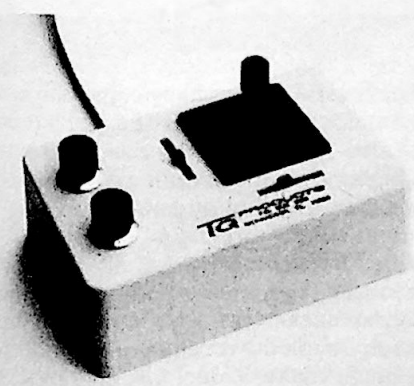
TG Super Joystick

The housing of the TG Super Joystick was the largest one tested. Its larger size coupled with the placement of the firing buttons on the left top of the case make it most suitable for table top operation. Some right handed players found it could be held in the left hand for games using only one firing button.

The firing buttons are large (0.6 in dia.) and flat; thus they are easy on the fingers. They do not provide any tactile feedback and must be pressed all the way down to make contact.

The joystick itself is self-centering, a handy feature for playing *Twerps*, *Borg* and other games in which it is necessary to remain stationary on the screen. Self-centering may be defeated by removing the bottom of the case (four screws) and, with a needle nose pliers, removing four small springs from the joystick mechanism. This is a mixed blessing. While it is handy to be able to defeat self-centering, it is not something you want to do frequently. After two back-and-forth changes, we decided to leave self-centering in effect permanently.

On the other hand, the trim adjustment controls are on the top of the case and are easy to adjust when necessary.



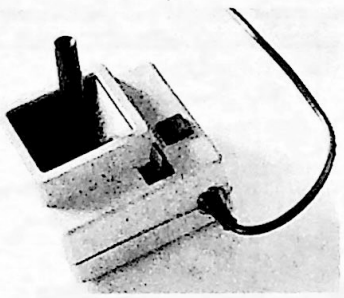
The joystick knob is on the small side and is held by friction to a non-threaded shaft. As a result, it occasionally came off during exuberant game play. However, as with the A2D stick, most players were able to adjust their playing style to compensate.

In summary, for a right-handed player the TG Super Joystick is a good quality product with some minor drawbacks that did not substantially detract from its overall performance.

Joystick II

Joystick II is a compact (3-1/2" sq.) joystick for either table top or hand-held use. Because of the firing button placement at the left top of the unit, it tends to favor right handed players.

The joystick handle is small in diameter (3/8"), but its length makes it comfortable to use.



The firing button for direction 0 is 1/2" square and provides both tactile and aural feedback. Unfortunately, the switch for direction 1 is just that, a switch. To the left, it is on (like a light switch) while to the right it provides momentary contact with spring return. We found this arrangement was not suitable for playing games such as *ABM* and *Pegasus II* which require the use of both firing buttons.

The first unit we received provided variable resistance in direction 0 of 30K to 130K ohms (values of 50 to 255 to the Apple) and thus could not get to the right boundary in most games. We removed two rubber feet, opened the case, and were able to adjust the shaft position on one pot to correct the problem. Another unit tested in a local computer store did not have this problem.

Installation of Joystick II is the best we have seen. A rubber strain relief 6" from the DIP plug end of the cable fits in the notch at the back of the Apple. A U-shaped ground clip connected to the cable shield fits over the notch thus minimizing RF interference.

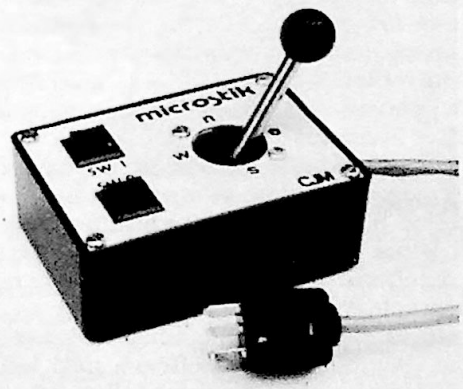
The instruction booklet is excellent and provides a test program. Were it not for the strange switch instead of a more desirable firing button, we would have given Joystick II our highest rating.

CJM Microstik

Of all the joysticks tested, the CJM Microstik had by far the easiest movement. In other words, the resistance to moving it in a given direction was virtually nil. Also, because of its larger ball (nearly 3/4" in diameter) and longer handle, it left all of the users with the impression that it was extremely easy to move and adjust. Indeed, it was one of the few joysticks that could be substituted for a paddle in games which required precise adjustment (*County Fair*, *Tsunami*, etc.). It was also suitable for use with games for which we normally recommend a switch-type joystick such as *Thief* and *Snack Attack*.

On the other hand, because the joystick moved so freely, several panelists complained that they felt themselves gripping it with a high degree of tension to keep it in the proper position, especially with games such as *Torax* and *Photar*. Nevertheless, the tension, in some cases contributes to accurate adjustment and some panelists found themselves getting excellent scores in these games. Others just found themselves unduly tense.

The pair of 1/2" square firing buttons on the left top of the joystick assembly strongly favored right handed players, i.e., those who wanted to control the joystick with their right hand and fire with their left. On games which required both firing buttons to be pressed, the joystick was most suited for tabletop use, whereas on games with only one firing button required, handheld control was possible with the left thumb controlling the firing button. The buttons are very short throw and provide aural, but not tactile feedback.

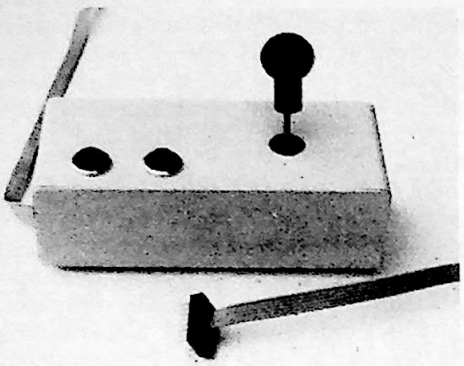


The cable is fairly short (3' 4") and terminates in a six-pin Jones plug which must be used in conjunction with a CJM Applexpander. Since this is designed to be mounted on the right outside of the Apple computer housing, the short cable length is not a disadvantage.

In summary, the CJM Microstik is of excellent quality throughout its exceptionally easy movement coupled with the long throw may well make this the joystick of choice for you.

Datamost Joystick

A metal case coupled with a 3/4" diameter joystick ball contribute to the solid feel of the *Datamost Joystick*. Two pushbuttons are mounted on the top left of the case toward the rear; unfortunately, they are somewhat small—just over 1/4" in diameter.



While the small size of the housing lends itself to holding in one's hand, we found that only one button could conveniently be pushed at one time. Thus, handheld use of this control was not suitable for games such as *Pegasus* and *ABM* which require both buttons to be used. For games such as this it was necessary to put the case down on a flat surface and control the buttons with the opposite hand (usually left) from the one controlling the joystick movement. One of our panel members who preferred lefthand control of the joystick and righthanded button pushing found this control rather awkward because of the left side position of the buttons.

Although button movement was very short (about 1/10"), a desirable feature, some of our panelists felt that more pressure was required to press the buttons than with other joysticks. Indeed, several of our panelists complained of finger fatigue after using this unit.

The Datamost joystick handle has extremely short play; as a result it has fast action but is difficult to adjust precisely. It is not self-centering nor does it have potentiometer adjustments. There are no instructions included with the unit.

In summary, for a righthanded player, the Datamost joystick offers a solid feel, quick action, 3/4" diameter ball and short button movement. Button pressure seemed high and button placement was awkward for lefties.

Astar Robo Stick-1

The Robo Stick-1 is a high-quality joystick imported from Japan by Astar International. Indeed, we found it good enough to use in place of paddles for games such as *Torax* and *County Fair* which require rather precise paddle movement.

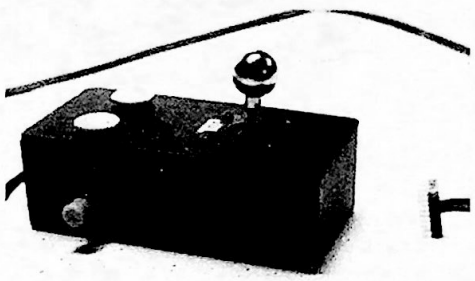
The resistance of Robo Stick is very low (75K ohms) which contributes to the feeling of precise movement. On the other hand in some games which look for the full 150K ohm resistance, Robo Stick was unable to reach the edge of the screen—a rather serious disadvantage.

The hand control is a nice chrome ball approximately 3/4" in diameter. Two 3/8" diameter pushbuttons are located on each side of the rear part of the black plastic case.

The firing buttons on Robo Stick are concave, i.e., the rim of the button is higher than the center. In games requiring much firing, this can be very hard on one's fingers.

We found it most comfortable to hold the case in either the right or left hand using the thumb and middle finger to control the two buttons while the other hand attends to the control of the joystick. People with small hands may find handheld use difficult.

We found that people had relatively strong preferences as to the placement of firing buttons and joystick controls. Those who liked Robo Stick-1 did not particularly like the TG joystick and others like it. These joysticks have both buttons to the



left side on the top of the control. In general this arrangement is more suitable for leaving on a flat surface while Robo Stick is more suitable for holding in one's hands.

Robo Stick-1 is not self-centering nor does it have potentiometer adjustments. We are told by the manufacturer that Robo Stick-2 will have a feature which will permit it to be either self-centering or not as the user desires.

The instructions for the Robo Stick-1 include a game program to check all of the functions. It's not a wonderful game, but it is a way of testing the joystick if you don't have any other programs which use a joystick.

In summary, were it not for the concave firing buttons and low resistance potentiometers, we would have rated Robo Stick outstanding. Because of the precision feel and good arrangement of firing buttons, we still think it is a good choice for playing most joystick games, particularly at the bargain price of $29.95.

Video Stik

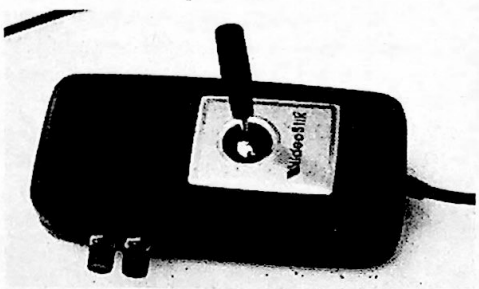
Three years ago the Video Brain computer was announced with much fanfare. It was a well-engineered unit designed to compete with the Bally Arcade, Interact Personal Computer, and others of its ilk. Unfortuntely, Video Brain made a bet on the APL language, their version being APLS. Unfortunately, this was not a wise choice and Video Brain went out of business within a year.

However, they manufactured a great number of joysticks and other accessories and kept the company afloat a while longer selling these accessories. Today, Video Brain is long gone, but their joystick lives on in the form of the Video Stik now marketed by Zircon.

The joystick itself has a longer stick and a longer throw than most other units on the market. This, coupled with its low 90K ohm resistance, allows more precise control than most other joysticks. On the other hand, like the Robo Stick, with certain games it cannot reach one extremity of the screen.

Video Stik is designed for handheld use and favors the lefthanded player because of the placement of the two firing buttons on the left side of the unit. In other words, when it is held in one's right hand, the two firing buttons may be easily controlled with the index and middle finger while the joystick may be moved with the left hand.

If used with an adapter such as Paddle-Adapple or software which allows interchanging the two axes, it is possible to reverse the normal axes thus permitting the joystick to be used upside down. Then it can be held in the right hand with the buttons controlled by the middle and ring finger of the left and joystick movement controlled by the right hand. Unfortunately, this reversal of axes is not always possible, hence Video Stick is probably best suited for lefthanded operation.



The handle occasionally came unscrewed, a minor annoyance. The firing buttons on Video Stik are slightly concave (outer rim higher than the center) and thus were somewhat fatiguing in games requiring a great amount of firing.

Video Stik comes with a 6' cable, two feet longer than most others. Although it has drawbacks, the long throw of the joystick coupled with the good handheld feel might make Video Stik the joystick of choice for you.

Kraft Joystick

The Kraft Joystick is mounted in the same large 4" x 4" x 2-1/4" housing as the Kraft Paddles. It is slanted forward by about 10 degrees and has two firing buttons in the upper left corner, one on the top and one on the back. Their positioning makes it convenient to fire with the thumb and the index finger or index finger and middle finger of the left hand. Like many of the other joysticks tested, the Kraft Joystick favors the right-handed player.

The joystick knob itself is 3/8" in diameter. There seem to be two schools of thought about knob size. One holds that knobs ought to be relatively large, similar to those found on coin-op arcade games, while the other holds that the joystick is a precision instrument and the knob ought to be small, like those found on model airplane RC controls.

Our game playing panel members had no strong preferences as to knob size. We did prefer that the knob not come off in one's hand during violent game play. Fortunately, the Kraft knob is well designed in this regard. It is permanently fixed to the staff and, although the staff itself unscrews from the controller ball, it did not unscrew during game play nor did it develop any annoying looseness as did several other joysticks.

Two levers on the housing (located below and to the left of the control stick) allow fine adjustments to the electrical center of the joystick. Each lever controls a separate axis (X or Y). As we mentioned before, we found this a most desirable feature, not only for game playing adjustments, but especially when using a joystick as a graphics input device.

We have also been heard to say how nice it would be to find a joystick on which self-centering could be turned on or off at will. Lo' and behold, the Kraft Joystick has such a feature.

To disengage the spring centering mode, the joystick is simply turned upside down and two little mechanical switches are moved to the "free" position. To re-engage the automatic spring centering, the switches are moved away from the free position—that is all there is to it!

Incidentally, the first joystick we got from Kraft had one of these two switches installed upside down, so we could move only the X axis to the free position. After taking the joystick apart completely, we determined that these switches were permanently glued in place and could not be fixed by the user. We notified the factory and got a new joystick promptly.

We were assured by several people at Kraft that this had never happened before, nevertheless, it might not be a bad idea to look over the joystick at your dealer and make sure it is completely functional before taking it home.

The Kraft Joystick has a generous 5' cord which is more flexible than most. Like the paddles, it has a curious little 6" wire with an alligator clip on one end attached to the DIP plug. This clip should be connected to a chassis bolt to ground the cable shield, a fact which is not mentioned in the instructions.

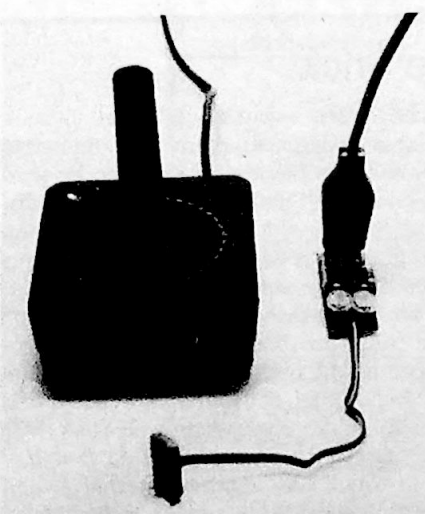
All in all, our game playing panelists were very enthusiastic about the Kraft Joystick. Although the push buttons provide no tactile or aural feedback, this lack is more than compensated for by the excellent features of the joystick: a tight knob, external trim adjustments and selectable operating mode (self-centering or free). The joystick is best suited for operation on a table top or in one's lap; there is no convenient way to hold it comfortably in one hand and operate the pushbuttons as well as the stick. Bottom line: highly recommended.

Switch-type Joysticks

Atari Joystick

Probably the best known joystick in the industry, the Atari Joystick has two main virtues: it is cheap and reasonably reliable. Buoyed by the sales of millions of video computer game systems, an Atari Joystick is now found in one out of five homes in America.

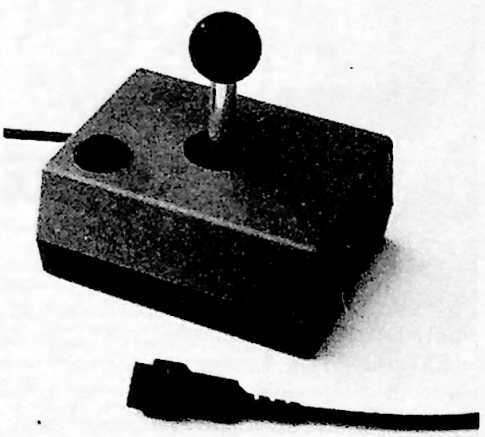
The mechanism is simple. Pushing the joystick tilts the 1-1/2" diameter nylon base of the stick against a dimpled piece of light metal on a printed circuit board. When the stick is released, the dimpled metal pops back to its original (off) position. The firing button operates the same way. Thus, all of the contact surfaces are protected under a thin layer of mylar on a printed circuit board. On old Atari joysticks, these switch contacts were exposed, thus leading to much earlier failure than newer ones are subject to. Nevertheless, the mechanism is hardly arcade quality and is likely to need replacing sooner than most other joysticks.



With the firing button in the upper lefthand corner, the Atari joystick is clearly designed with the righthanded player in mind, i.e., the joystick is operated with the right hand and the firing button with the left. Of all of the switch-type joysticks tested, the Atari took the highest amount of force to move in a given direction. Nevertheless, with a list price of $13.95 each, frequently discounted to far less, the Atari Joystick is a good buy and seems destined to be with us for a long time to come.

Newport Prostick

The main business of Newport Machine Design is manufacturing joysticks for the video arcade game industry. Now, they have taken their Model 150 arcade-game joystick, mounted it in an attractive plastic case with a firing button, added a cable, and market it as a replacement for the Atari Joystick. In all respects, it is superior to anything else currently available (with one exception—see below). The 1" diameter ball is permanently attached to the shaft so it can't come off in your hand as others occasionally do.



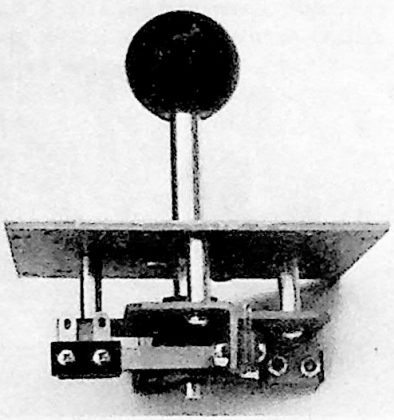
The joystick uses four leaf switches which are closed when a 1" diameter nylon "contactor" (attached to the end of the joystick) is pressed against the moveable leaf. This contactor is held in place by a spring and a "C" clip. If the user desires, this contactor may be reversed to put more pressure on the spring and thus provide higher resistance to joystick movement. We don't recommend this change, as the way the joystick is shipped provides excellent feel and positive centering.

Another good feature about the Prostick is that all parts may be replaced individually without replacing the entire unit. Thus, if the contacts on one of the leaf switches becomes worn and filing with emery cloth does not restore it to reliable operation,

one need replace only the one faulty switch. This is not possible with any of the other joysticks we tested.

If we have one complaint about the Newport Prostick, it would be with the firing button (the one component not manufactured by Newport). The button has a longer throw and is harder to press than the one on the original Atari joystick. As might be expected, this led to player fatigue in games such as *Onslaught* which required almost continuous button-pressing. Nevertheless, most players found that with Prostick their scores on most games could be doubled or tripled on the first play. For example, one player immediately reached the seventh screen on *Snack Attack*, whereas his previous high had been the third screen.

In summary, this is a superb joystick for the serious and even not-so-serious game player. Newport Machine Design was started eight years ago by Werner Marhold when he emigrated to California from his native Germany. Thus, it would be unfair to say that the Newport Joystick is the Cadillac of the industry, rather one should call it the Mercedes.



Since the Newport Prostick is not widely available in retail computer stores, we have listed the east and west coast distributors of the product.

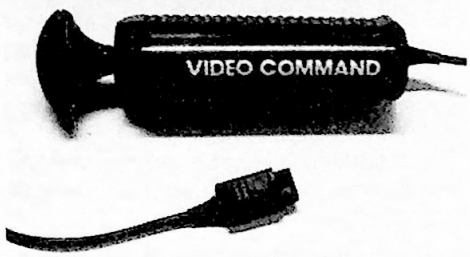
For the do-it-yourselfer Newport also markets their top-of-the-line Model 125A arcade game joystick. The Model 125A sports a large 1-3/8" diameter ball permanently attached to the shaft. Four high-quality leaf switches are held with machine screws and lock washers to a steel switch plate, which in turn, is held with four screws, lock washers and spacers to a heavy steel mounting plate. Four interchangeable nylon bushings come with the unit which permit two, four or eight way operation. As with the Model 150, the spring may be reversed on the contactor to provide more forceful operation.

The Model 125A Joystick along with a five foot long cable with DE-9 (Atari) connector on one end is available direct from Newport Machine Design, P.O. Box 418, Bishop, CA 93514, for $34.50 postpaid. Do not send to Newport for the Model 150 Prostick; only the Model 125A is available direct. Watch *Creative Computing* in an upcoming issue for an article on how to use this joystick to build your own high quality unit for the Apple, Atari or VIC.

Zircon Video Command

Remember the Fairchild Channel F video game unit? Everyone liked the joysticks. Channel F didn't survive, but the joysticks did, and Zircon bought them.

The Video Command Joystick is a replacement for the Atari joystick. It is about 5" long and 1-1/2" in diameter,



designed to be held in one's hand. The moving joystick control at one end may be controlled by the thumb of the hand holding Video Command or by the other hand. The firing button is built-in: depressing the entire joystick mechanism closes the contact.

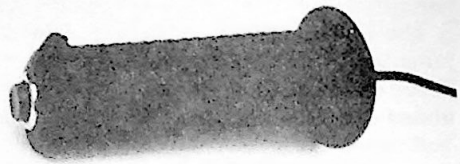
We found this to be an outstanding replacement for the Atari joystick in most games—most games for the Atari that is. Its short, positive throw coupled with the built-in firing button makes playing games such as *Star Raiders* and *Onslaught* a positive joy. It is also excellent for most games on the Atari Video Computer System.

However, since movement is so easy with Video Command, it is not a good choice for playing games which require positive movement and a return to the center position between movements, i.e., Pac-Man and its derivatives and Berzerk and their derivatives. For these games we found the more positive spring mechanism in the standard Atari joystick highly desirable.

Le Stick

Le Stick is a switch-type (Atari) joystick with a difference: there is no movable joystick! Le Stick is designed to be held in one's hand and simply moved forward and back, right and left to signal the program what you wish to do. It achieves this amazing action by having a set of mercury switches inside which detect when Le Stick has been tilted 20 degrees or more in one direction. The firing button is still of the conventional type and is found on the upper end of Le Stick. It is designed to be pressed with the thumb.

Le Stick has another internal switch which is activated by squeezing the handle. This "turns off" Le Stick and prevents any signal from going to the computer until it is released. We haven't found any



use for this with commercial games, but it might be handy when writing your own.

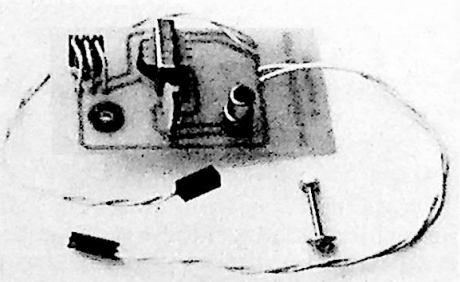
We found that Le Stick takes some getting used to. Indeed, some players found it so "foreign" that they elected quickly to return to a conventional type of joystick after our test was over. Other players, on the other hand, loved Le Stick—especially the freedom to play with one hand.

Of all the joysticks tested, Le Stick was the most different. People had no middle-of-the-road opinions about Le Stick; they either hated it or loved it. We advise trying out Le Stick at a dealer or show; you may well find that it is the joystick for you.

Happ Hi-Fi Adapter

We have mentioned several times on these pages that the built-in Apple speaker leaves a lot to be desired and that a great improvement in sound can be obtained by replacing the Apple speaker with an external one. For maximum convenience, we have recommended that an SPDT toggle switch be installed on the side or back of the case to make switching between the two speakers convenient.

Now Happ Electronics has come along with an even more exotic and convenient device. The Hi-Fi Adapter consists of a small PC board which is mounted on the right inside of the Apple case. The handle of a toggle switch extends through the cooling fins on the right of the Apple case. The unit plugs into the Apple speaker connector and has two outputs. One simply



connects to the internal Apple speaker and, with the toggle switch down, allows for "normal" operation. With the toggle switch in the up position, the sound is routed through a small isolation transformer to the input of a hi-fi amplifier.

As anyone who has tried to connect the Apple speaker output directly to a hi-fi amplifier knows, both sides of the speaker

output are above ground and connecting one side to the ground of an external amplifier creates havoc in the Apple. This havoc takes a variety of forms, the most common of which is the equivalent of constantly hitting the reset key. Needless to say, this is highly undesirable. The Happ Hi-Fi Adapter cures this problem and makes it possible to run the speaker output through a hi-fi system.

Since the Apple puts out only one channel of output, we recommend for amplifiers without a monaural switch that a Y connector be used to split the signal into two channels. Short connector cables (one RCA female input, two RCA male output jacks) are available from Radio Shack and other electronic supply houses for about $2.00.

If you have not used an external speaker (or amplifier), we can confidently predict that you will be astonished at the results.

The Happ Adapter comes with a short program called Apple Bagpipes. After typing it in, you will be able to achieve a wide variety of different sounds by simply typing one key from the keyboard. Although the instructions do not state this, in order to try out different sounds, you must press reset and run the program again for each different sound. This program gives only a small sampling of the possible sounds available from the Apple. *Electric Duet* from InSoft and games such as *Juggler* or *Tumble Bugs* demonstrate a much wider range of possibilities.

The documentation included with the Hi-Fi Adapter was excellent, particularly the photographs which showed exactly how it was to be installed.

We found the device substantially enhanced the fun of playing games on the Apple and was well worth $25.

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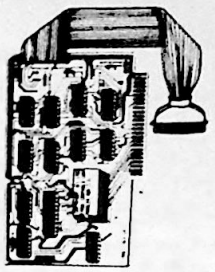

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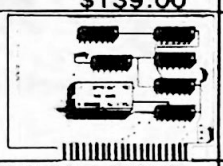

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Joysticks

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Joysticks, Potentiometer-type										
A2D	2001	$44.95	3.0 x 3.5 x 2.0	Both	150K ohms	Yes	0.4	0.6 sq	Rear side	Yes
Astar International	Robo Stick-1	29.95	2.6 x 5.0 x 1.7	Both	75K	No	0.75	0.4	Both sides rear	No
BMP Enterprises	Joystick	59.00	(1)							
CJM	Microstik	59.95	4.0 x 2.8 x 1.6	Table	110K	No	0.7	0.5 sq	Left top	No
Datamost	Joy Stick	59.95	2.1 x 5.0 x 1.8	Table	150K	No	0.75	0.3	Left top rear	No
The Keyboard Company	Joystick II	49.94	3.2 x 3.2 x 1.5	Both	150K	No	0.4	0.5 sq	Left top rear	Yes
Kraft	Joystick	64.95	4.0 x 4.0 x 2.3	Table	150K	Yes	0.4	0.4 sq	Left top & side rear	Yes
Syntronics	Applestix	34.95	(1)							
TG Products	Super Joystick	59.95	5.0 x 3.2 x 1.7	Table	150K	Yes	0.4	0.6	Left top	No
Zircon	Video Stik	49.95	2.5 x 5.3 x 1.6	Hand	90K	No	0.4	0.4	Left side rear	No
Joysticks, Switch-type										
Atari	Joystick	13.95	3.5 x 3.8 x 1.5	Both	-	-	0.6	0.6	Left top	No
Datasoft	Le Stick	39.95	1.5 dia x 5.0	Hand	-	-	n/a	0.4	Top	No
Newport	Prostick Series B	34.95	3.3 x 4.4 x 2.0	Table	-	-	1.0	0.5	Left Top	Yes
Zircon	Video Command	14.95	1.4 x 2.0 x 5.0	Hand	-	-	1.8	1.8	Top	No

(1) Not evaluated in this issue

Apple Paddle Controls and Game Port Extenders

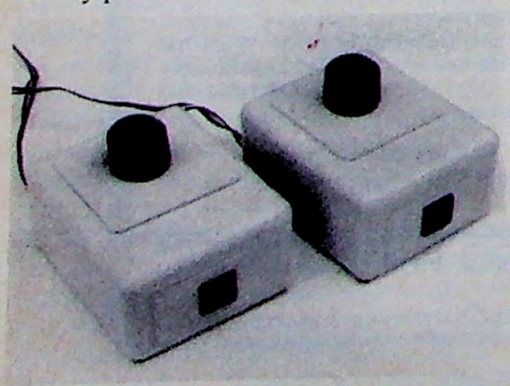
David H. Ahl

A2D Paddles (2002)

The A2D model 2002 paddle controls were physically the largest ones in this test. Children or women with small hands may find these controls too large for handheld use. On the other hand, most of our players judged them just fine.

Since the case is nearly square and the firing button is located in the center of one side (or end), it is equally easy to use with practically any finger of either hand. All of our players liked the large size (0.6" square), short throw, and positive click of the A2D firing button.

The knob is just under 1" in diameter, a size preferred by most players. Rotation is easy and provides precise adjustment to any point on the screen.



A diode isolation circuit prevented us from measuring the resistance of the potentiometers in the A2D paddles. However, as mentioned above, they provide precise control to any point on the screen.

The ribbon cables are a generous 8' long. Unfortunately, there is no indication which is paddle 0 and which is 1 (out comes the trusty masking tape). Each paddle has an internal trim adjustment, however, no instructions are given for using this and we assume, that once adjusted at the factory, there should be no further need for user adjustment.

Apple Paddles

Early Apple owners will remember the flimsy plastic paddles with miniscule firing buttons that came with the original Apple computers. Over the years, the design has changed several times; we tested one of the common types for comparative purposes. The paddles currently sold by Apple are described below.

The Apple Paddle is a small rectangular unit designed for handheld operation. The knob is just over 1-1/4" in diameter which most of our panelists deemed to be the "right" size. Not so for the firing button. It is minute (3/16" diameter) and leaves a nasty indentation in the finger pressing it.

The placement of the firing button on the left top of the case is less than optimal. In this position, it almost requires that the paddle be held with the left hand and the firing button operated with the thumb while the right hand attends to the knob. Left handed players will find that they must hold the case in their palm, reaching around to the top with the index or middle

finger of the right hand to operate the firing button while turning the knob with the left hand. This sounds a bit awkward, but at least it allows one to alternate between two fingers doing the firing when the indentation in one becomes unbearable.

All in all, the Apple Paddle makes it obvious why a replacement market has

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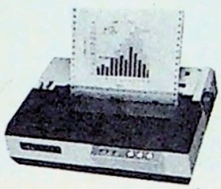

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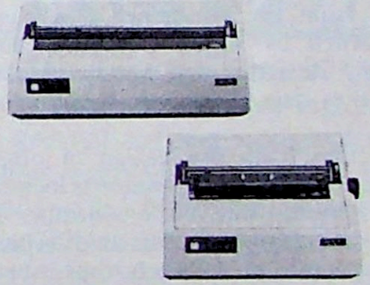

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sprung up to produce more user-friendly devices.

Incidentally, it is possible to improve the old Apple Paddle controllers dramatically for about $3.00 and one-half hour of time. The improvement comes about by replacing the firing button and the control knob.

There are many momentary-contact SPST switches that will fit in place of the existing one in the Apple paddle. Find one that has a large surface for your finger (3/8" diameter or more), short throw, and positive feel. I found some at the Trenton Computer Festival Flea Market for $0.50 each.

The other thing you will want is a new pair of knobs. Look for ones about 1" in diameter that are held on with a setscrew rather than the knurled friction fit of the existing Apple paddle knobs.

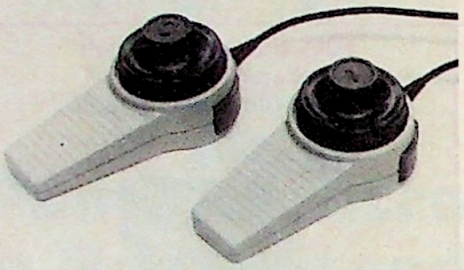
Pop open the case of the Apple paddle control (some have one screw, some don't), unsolder the old switch and remove it, and install your new switch. If your new switch requires a larger hole than the existing one, you'll have to enlarge the hole with a rattail file. Solder on the wires. Be sure to use the set of normally open (NO) contacts if you have an SPDT switch. Reassemble the case. Pry off the old knob and put on your new one. You'll be amazed at the difference!

Hand Controller

These attractive, wedge-shaped controllers from the Keyboard Company (now owned by Apple Computer) are obviously designed for handheld use, though they may be used on the tabletop as well.

Departing from the design of other manufacturers, the firing button is located on the right rear side of the controller. It is a large rectangular controller which pushes down a microswitch, thus it provides both tactile and aural feedback. While extremely easy to press, some players felt that the large size of the button tempted them to hold their finger on it thus preventing the quick release required in games needing fast firing. In other words, these players felt they had to consciously both press and release the switch. On the other hand, some other players (right handed) liked being able to control the firing button with their left index finger instead of a thumb.

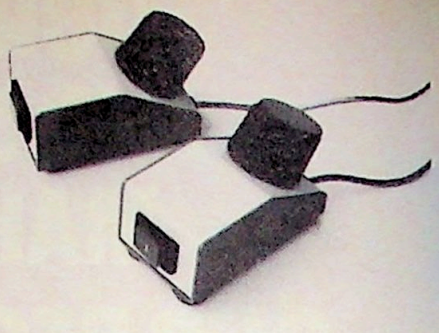
The knob is a two-tiered design, the center of which is about 1" in diameter and the outside just over 2". We found this design was quite satisfactory for players who liked a small knob as well as those who liked a larger one. Detracting from the pleasing knob design, potentiometer rotation was rather stiff which some players felt hampered game play. On the other hand, I achieved my all time high score in *Tsunami* with this set of paddles.



A thoughtful touch is the molded "0" and "1" on the center of each paddle knob. Also thoughtful is the strain relief on the cable which goes in the notch of the Apple computer behind the game I/O port. In addition, a grounding clip is provided which is connected to the cable shield to minimize RF interference. These were the only paddles with an external cable ground.

Pro Paddles

These paddles were by far the most diminutive of those tested. They measure a scant 1-1/2" x 2-1/2" and have a 1" diameter knob. A 3/8" square firebutton is mounted on the back of the paddle. A thoughtful touch is the numbers 0 and 1 inscribed on each knob. This is a far tidier way of identifying paddles than the strips of masking tape I have on the backs of other paddles.



The small size of the Pro Paddles was praised by some members of our panel along with the placement of the firing button which makes it very easy to hold the paddle in one hand using first or middle finger to fire while the other hand controls the rotation. The fire buttons have a very short throw and a definite tactile feel when contact has been completed which some players found to be an advantage. Having the firing button squarely in the back also does not unduly favor right or left handed people. On the other hand, some people felt that the size of the Pro Paddles was just too small. However, this seemed to be a matter of preference because others liked the size very much.

In place of the flat cables found on many paddles and joysticks, Pro Paddles use a round, 3-1/2' cable for each paddle. While 6" to 12" shorter than most others, the round cables seem to be more flexible than flat ones and the difference in length was not noticed. Indeed, if a game extender is used, there is no reason for joystick and paddle cables to be over 2' or 3' long.

The potentiometers in the Pro Paddles seem to be stiffer than others, i.e., more difficult to turn and adjust. One player felt that this was an illusion as a result of the small size. As we did not measure this variable, stiffness remains a subjective observation.

Apparently there are two different designs of the Pro Paddle; please see the photograph which shows the one that we tested.

In summary, the reaction to the Pro Paddle had more subjective factors than most others—small size, button placement, and stiff rotation. Some people liked the Pro Paddles very much while others were

Apple Paddle Controls

Manufacturer	*Model/Name*	*Price*	*Size W x D x H*	*Table Top/ Hand Held*	*Potentiometer Resistance*	*Trim*	*Knob Size (in dia.)*	*Button Size (in dia.)*	*Button Placement*	*Tactile Feedback*
A2D	2002	34.95	3.0 x 3.5 x 2.0	Both	n/a	No	0.9	0.6 sq	Rear side	Yes
Apple Computer	Paddles (original)	39.95	2.5 x 3.2 x 0.8	Hand	150K	No	1.3	0.2	Left top rear	No
The Keyboard Company	Hand Controller	29.95	2.0 x 4.5 x 1.0 (1)	Both	150K	No	1.0/2.0	1.0 x 0.6	Right side rear	Yes
Computer Works	Pro Paddles	49.95	1.5 x 2.5 x 1.3	Both	150K	No	1.0	0.4 sq	Rear side	Yes
Kraft	Paddles	49.95	4.0 x 4.0 x 2.3	Table	150K	Yes	1.2	0.4 sq	Left rear	Yes
Tech Designs	Adam and Eve	39.95	2.0 x 3.5 x 1.0 (1)	Both	150K	Yes	0.9	0.4 sq	Left side rear	Yes
TG Products	Super Paddles	39.95	2.0 x 4.0 x 1.0	Both	135K	No	1.4	0.6	Left side rear	No
Zircon	Alpha Command	19.95	2.0 x 4.3 x 1.0 (1)	Hand	150K	No	1.0/1.7	0.4	Right side	No

(1) Shape is not rectangular (2) Not available in time for this test

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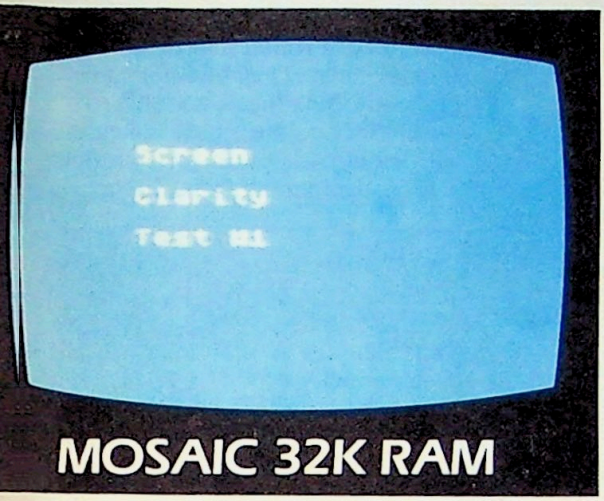

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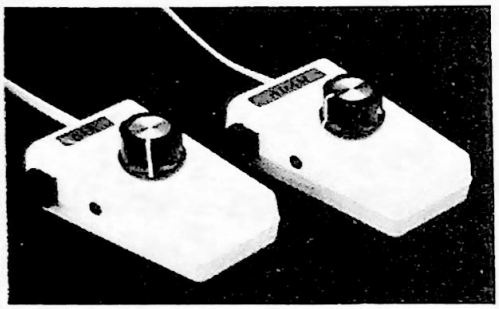
lukewarm. The best bet is to look at a pair in your local computer store or at a show before you buy.

Adam and Eve

The Adam and Eve Paddles are an attractive, hand-fitting trapezoidal shape. The firing button is on the left rear side of the case, thus making it easy for both right and left handed players to control. Curiously, paddle 0 is labeled Eve and paddle 1 is labeled Adam.

The knob is just under 1" in diameter which most players found convenient particularly for fast movement from one end of the rotation to the other. Move-



ment of the potentiometers was easy and precise.

The 3/8" square firing button has a very short throw and a positive click when pressed, thus providing both tactile and aural feedback.

Each potentiometer has a trimmer control which allows the paddle to be matched precisely to your computer or particular games. These were the only paddles with an adjustment of this type. This trimmer is also said by the manufacturer to be able to compensate for excessive wear, a useful feature.

The five-foot cables to the paddles are more flexible than most and Tech Designs has thoughtfully provided a stress relief at the DIP connector end to prevent the cable from being pulled out of the back of the Apple.

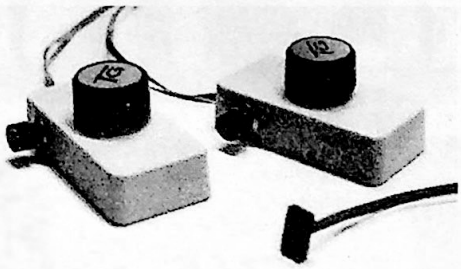
In summary, we felt the Adam and Eve paddles were exemplary in all regards.

TG Super Paddles

The TG paddles are rectangular in shape with the firing button on the left rear side of the case. This position is suitable for either left or right handed players. The size lends itself to either handheld or table top use.

The firing button is a large 0.6" in diameter but, unfortunately, has a fairly long throw and no positive feedback when contact is made. Some players felt that this button provided less-than-precise control of firing and also contributed to finger fatigue. Other players barely noticed.

The knob was the largest of any paddles tested, 1-1/4" in diameter. Since most games use only a portion of the potentiometer rotation, theoretically a large knob can be adjusted more precisely. Indeed,



with our playing panel, the size led to sharply divided feelings: some players liked the large knob very much and others did not. On the other hand, all players agreed that the TG paddle could be adjusted very precisely and that the potentiometer was exceptionally easy to rotate.

Older TG paddles used a round cable, while new ones are coming through with ribbon cables and improved DIP connectors. There are no cable strain reliefs. Paddle 0 is designated by a red TG logo and paddle 1 by a black logo, a thoughtful touch (assuming you can remember which is which).

Zircon Alpha Command

Under pressure from the FCC because of excessive RF radiation, Apple Computer stopped shipping paddles with their computers about 1-1/2 years ago. Did you ever wonder what happened to all of those paddles in stock? Well we can't be sure, but indications are that the latest models were bought up by Zircon and are now being offered as the Alpha Command paddles. If they are not the exact Apple paddles, they are an awfully good imitation.

Designed for handheld use, the Alpha Command paddles have a firing button on the right side of the unit. The paddle is shaped so that either left or right handed players will be able to hold it and press the fire button with either thumb, index finger or middle finger. The firing button has a relatively long throw and is concave in shape (outer lip higher than inner part of the button), hence it is somewhat uncomfortable for sustained firing. Also, some of our panelists were not pleased that the button did not provide either tactile or aural feedback.

On the other hand, the two-tiered knob was judged easy to move and met the needs of both those players who like a smaller knob (1" in diameter) and those who like a larger knob (1-3/4" in diameter). Adjustment of the potentiometer was accurate and precise on all games tested.

The cables are round and flexible and just over 4' long. They do not have a strain relief or shielding.

If you are looking for a bare bones, but adequate set of paddles, the price is right on the Alpha Command from Zircon.

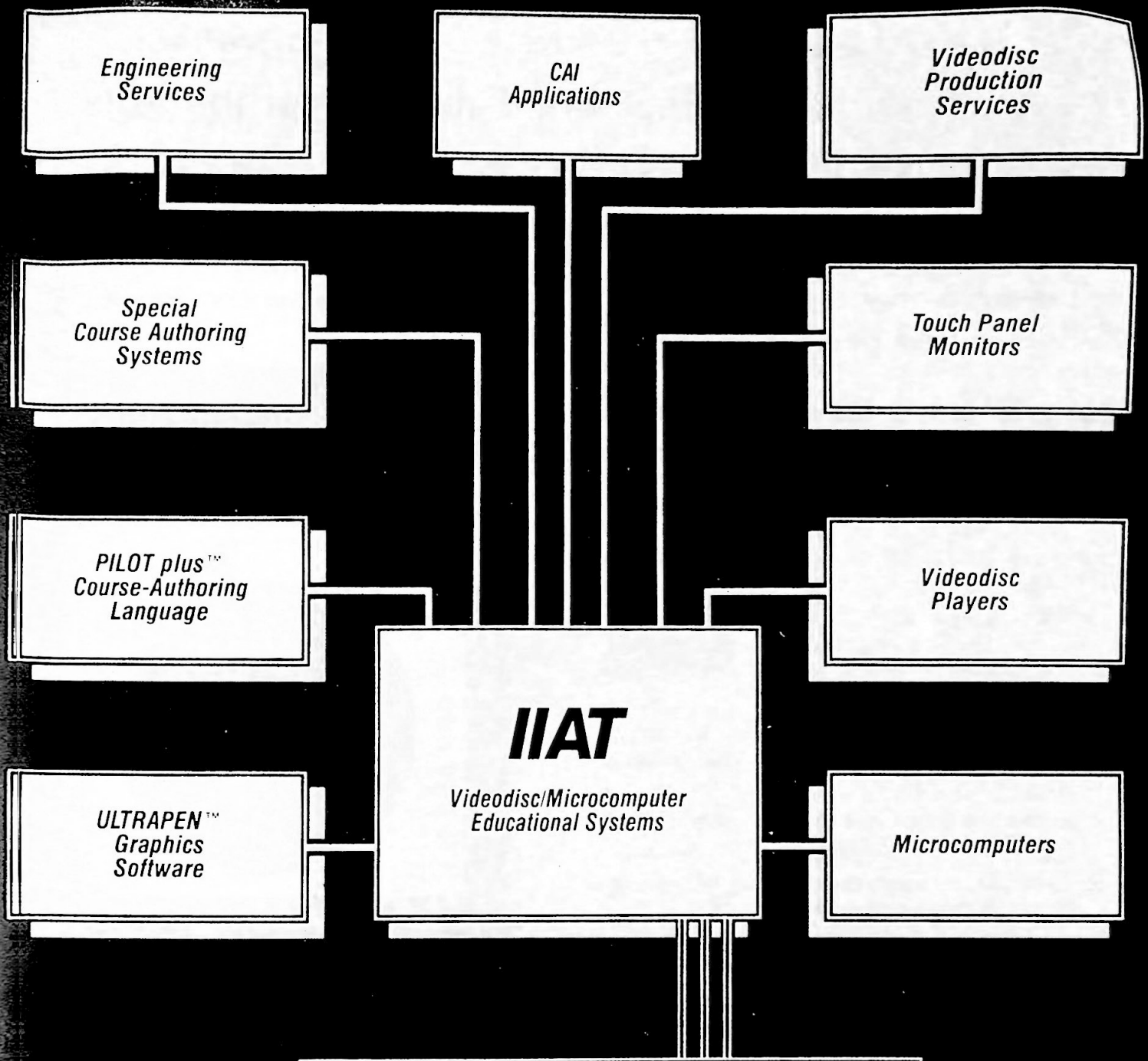
Kraft Paddles

The first thing that strikes one about the Kraft Paddles is that they are big. Measuring a bulky 4" x 4" x 2-1/4", they were by far the largest of the eight sets of paddles that we evaluated. The knob is correspondingly large, measuring 2" in diameter. The top of the case slants forward at about a 10 degree angle thus making the paddles most suitable for table top use. While people with large hands may find them suitable for handheld operation, most of our panelists preferred to use them on a table top or in their lap.

Upon picking up the Kraft Paddles for the first time, most of our panelists were surprised that the knob didn't rotate very far, 60 degrees to be exact. Indeed, the full resistance (0-150K ohms) is reached in just 54 degrees of rotation. This contrasts with a "normal" paddle (or potentiometer) which has over 300 degrees of rotation.

Apparently the designers of the Kraft Paddle felt that a short throw (or rotation) would give quicker response on the screen. They are right! Indeed, you can move missile bases, space ships, and other objects across the screen so fast that movement in some programs appears quite jerky. On the other hand, there is no denying that the paddles provide extremely quick response.

We were initially afraid that this type of design might sacrifice something in precision adjustment. In other words, if 150K ohms is spread over 300 degrees of rotation, virtually any point on the screen (in the X or Y direction) may be addressed by one paddle or the other. However, if this same 150K ohm resistance is confined to just 54 degrees of rotation, we were afraid that not every point could be addressed precisely. However, this was not the case. Every point could be reached, although holding the paddle steady on a particular point (for instance to get the bonus targets in



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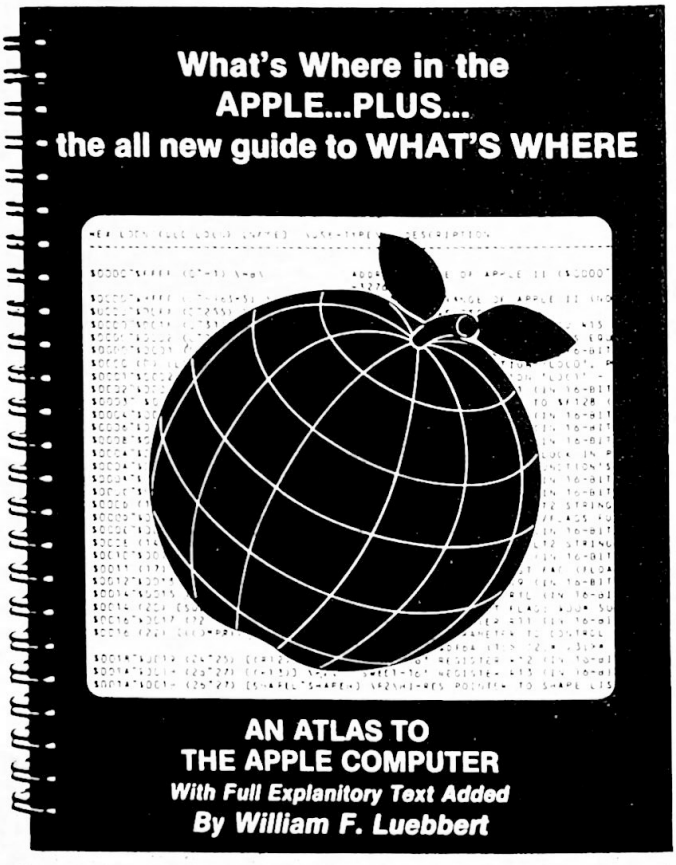

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Paddles, continued...

County Fair) was something else again! If you get the jitters after a cup of coffee, even a wee little bit, you won't be able to hold this paddle steady.

A feature which received mixed reviews from our panelists was the knurled knob design. People who grip the paddle quite intensely found themselves with miniature ridges on their fingures after a particularly grueling game of *Tsunami*.

The firing button is located on the upper left corner of the paddle housing. It is 3/8" square and has a relatively long throw. Although it does not provide aural or tactile feedback, we found that it gave good control and was not fatiguing in long use.

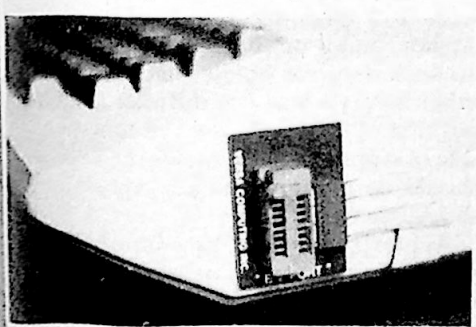
The cables are a generous 5' long and are more flexible than most. A curious element is a short wire with an alligator clip at one end attached to the DIP connector that plugs into the game port. The instructions gave no clue as to what this is for. A phone call to Kraft revealed that it is a grounding wire for the cable shield and should be attached to the chassis ground of the Apple (a mounting bolt is satisfactory).

In summary, the Kraft Paddles are unusual because of their large size and their short 60 degree rotation. These features had strong appeal for some people. However because they are significantly different from other paddles, we advise that you take a look at them and perhaps play a game or two in your local computer store to be sure that they will meet your personal needs.

Game Port Extenders

E Z Port

E Z Port from Versa Computing is a simple, straightforward extension I/O port for the Apple. It comes with a long 24" ribbon cable which probably makes for lots of RF interference but permits E Z Port to be mounted practically any place you desire: top, bottom, right, left, etc.

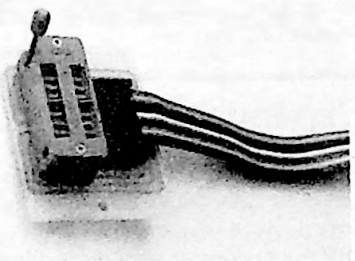


The device itself measures a dimunitive 1-1/2" x 2", just large enough for the cable connector and a zero insertion pressure DIP socket. Using this ZIP socket, you merely plug in the DIP connector from your joystick, paddle, etc. and throw a small switch which engages the connections within the socket. Mounted on the right side of the Apple, pin 1 is up and toward the front, a convenient position since the notched part of DIP plugs corresponds to pin 1. All in all, E Z Port is a simple, handy device.

Happ Game Socket Extender

This simple, functional device consists of a small PC board on which is mounted a zero insertion pressure 16-pin DIP socket with a sticky back designed to be mounted on the right side of the Apple case.

It has a 24" flat ribbon cable which can be snaked through the bottom or top of the Apple terminating in a DIP plug which goes into the game I/O port on the motherboard. To connect paddles or



joysticks, the DIP connector is simply plugged into the ZIP socket and the small lever switch thrown to the up or down position depending on how the board has been mounted.

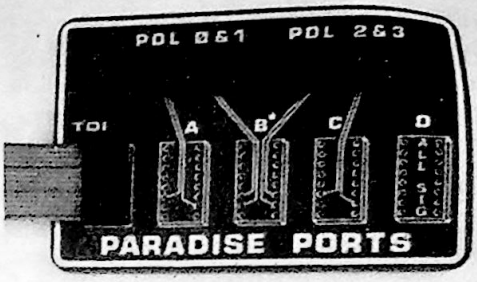
Although Happ recommends that the board be mounted with the switch in the down position, we found it far more convenient to mount it so it was facing up and toward the front of the Apple case. In this position, pins 1 and 16 are toward the top which conforms to our recommendation identifying the end of the DIP connector with a small dab of liquid paper or white paint. Furthermore, in this position the cable leads to the back of the Apple case and can be neatly snaked out of the way.

The device works well and is a bargain at the suggested $14.95 retail price.

A second version, Model GS-2, is the same as the GS-1 with the addition of an extra female socket on the male plug end (inside the Apple case). This is useful for certain decoder chips and other devices which must always be plugged in and work in parallel with paddles, joysticks, etc.

Paradise Ports

On the 2-1/2" x 3-1/2" surface of this game extender device are mounted two switches and a jack to the 18" cable that plugs into the Apple game port. In addition, four sockets are provided to plug in paddles,



joysticks, etc. The design is unusual in that the sockets are actually a part of the printed circuit board itself. Sockets A, B and C are switchable, while socket D is permanently wired in parallel with the Apple game port. Socket A always goes into paddle port 0 and 1, while socket C always goes into paddle ports 2 and 3. Socket B may be switch selected for either one or both.

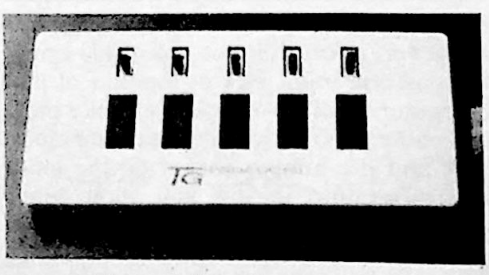
The entire back of the blue printed circuit board is covered by a rubber cushion pad. Together, the PC board and pad are only 5/16" thick. While the instructions state that Paradise Ports is "mountable on Apple case," short of using Contact cement or drilling screw holes, we could not figure out an easy way to mount it on the case. Nevertheless, its compact size means it does not take up much space on a desk or table.

TG Select-A-Port

Select-A-Port is an extender which allows up to five devices to be selected singly or simultaneously for input to the Apple. It is relatively compact, measuring 6" x 3" x 1/2" and has five DIP sockets with a switch above each one. With four small rubber feet, it can be used flat on the surface of a table or a desk or even the top of the Apple. In addition, two small plastic mounting brackets are included which permit it to be suspended from the cooling fins on the left or right side of the computer.

Socket number 1 is a non-switchable socket which directly parallels the game I/O port. This is for sensitive devices with which diode isolation would interfere.

Sockets 2-5 are diode-isolated and switch selectable. Socket 2 modifies the device



plugged into to it to operate paddles two and three which is useful in applications requiring dual joysticks or four game paddles. Sockets 3 to 5 parallel the game I/O port and are useful for paddles, joystick, light pen, etc.

Extenders, continued...

The instructions provided with Select-A-Port are scant but sufficient.

Select-A-Port is well designed and functional. We particularly like the individual switches on each port which allow external devices to be used one at a time or several simultaneously, something not possible with other extension port devices. The compact size is also a decided plus.

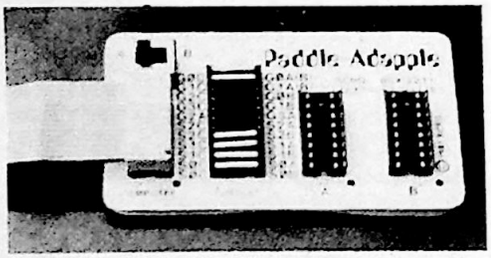
Paddle Adapple

Paddle Adapple goes one step beyond a game port extender in that it may be used in two modes. First, it may be used as a simple switch between two game ports; second, it allows for up to four paddles or two joysticks to be input to the Apple.

Paddle Adapple consists of a 2" x 3" sticky backed PC board on which are mounted three DIP sockets (one input, two output), a small switch, and a jumper socket.

To use Paddle Adapple as a switch, one device is simply plugged into DIP socket A and the other into B. The small side switch is moved to either position A or B thus selecting that device. In this mode the six jumpers installed with the unit as it is shipped are left in place. However, it is possible to change two jumpers to reverse paddle 0 and paddle 1 in case you have worn out your paddle 0 from playing too many games.

The second mode of operation uses the jumper socket to provide a wide range of input combinations to the Apple. For example, two joysticks or four paddle controls may be input simultaneously to ports 0, 1, 2 and 3. Unfortunately, although the Apple accepts input from four devices,



it only has three "fire button" inputs. However, a fourth input is possible using the cassette input jack at the rear of the computer. Paddle Adapple includes a plug and cable to go between the cassette input jack and the jumper socket on the unit. For those into it, this will allow four-player paddle/fire button games to be written.

The jumpers can also be used to exchange the X and Y axis on joysticks, use a light pen and paddles (or joystick) simultaneously, or use shift key modifications that plug into the game I/O socket.

The 14" cable on the Paddle Adapple permits it to be mounted any place on the right side of the computer. Our one minor complaint is that the two output sockets are not zero insertion pressure sockets. Although theoretically one should not be changing devices around much with Paddle Adapple, we regularly use three, and occasionally four, devices which must be plugged in through the game I/O port. Thus, we prefer zero insertion pressure sockets.

Another minor complaint: when mounted on the right side of the Apple case, pin 1 is down to the rear, which is not the "natural" way one might expect to plug in a device. This is a very minor complaint, as the manufacturer obviously did not intend that the devices be plugged and unplugged from Paddle Adapple with any frequency.

Paddle Adapple comes with six extra jumper cables—enough for doing practically anything as well as replacing a cable or two. It also includes a cassette input cable and a comprehensive eight-page instruction manual.

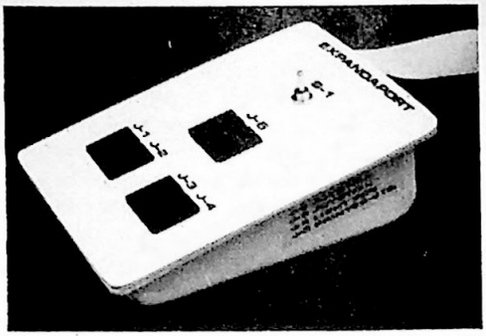
Expandaport

Measuring 6" x 4" x 2", Expandaport was physically one of the largest extension port devices that we tested. Its six input DIP sockets were also more than found on any other device. They are clustered in three pairs on the top of the unit along with a small three-position toggle switch.

The instructions recommend that connector J-1 be used for game paddles and J-2 for a joystick. J-3 is wired for an additional joystick input (or two paddles) to ports 2 and 3. It is recommnded that J-4 be used for a lightpen. These three inputs (J-1, J-2 and J-3 together and J-4) are selected with the three-position toggle switch.

Two additional sockets labeled J-5 are also available. It was not clear from the instructions how these were selected. Trial and error proved that they were both permanently wired in parallel with the input I/O and the position of the switch has no effect on them.

Expandaport also has a small speaker mounted in the left side of the unit and a cable which plugs into the Apple speaker connector on the right front of the motherboard. We have long been proponents of an external speaker for the Apple and found that it has ample power to drive a good quality 8 ohm extension unit. Indeed, the volume from an inexpensive $15 or $20 speaker is five to six times that from the internal Apple speaker. Thus, we had great expectations for the Expandaport extension speaker. Alas, the reality is that the sound is of lower volume and quality than that provided by the internal Apple speaker. The speaker in Expandaport is smaller than that in the Apple and has a



sound reminiscent of the earphones that came with early transistor radios.

Expandaport comes with a generous 33" cable. Unfortunately, the instructions are not equally generous in their explanation of how to use the device. The best part of the instructions is the program which tests every function of every device that can be plugged into Expandaport. On the other hand, the instructions do not tell the user what to do about software protection devices, and lower case adaptors, which may require use of the game I/O. (They can be plugged into J-5.)

In summary, for most applications, the paucity of instructions will pose no problem. Our advice: ignore the speaker and look at Expandaport as a versatile, convenient, expansion I/O port device.

CJM Applexpander + S

The Applexpander is part of the CJM Microsystem, a comprehensive input, output and control system for the Apple. It differs from all the other expanders in that the Applexpander uses Cinch Jones plugs and sockets, thereby requiring the purchaser to use only CJM components. A Jones plug to DIP socket converter is offered by CJM, but that seems to be defeating the purpose of the Microsystem.

As mentioned, this is more than just an extension port. We will first look at the input capabilities and then the output/control capabilities. Like other expansion devices, the 18" ribbon connector is designed to snake through the top of the Apple case after it has been plugged into the Apple game I/O port. The instructions refer to a diagram A for mounting the Applexpander on the case, but there was no such diagram in the manual. On the other hand, it was not difficult from the position of the sticky backed tape on the side of Applexpander to determine how it should be mounted on the right side of the Apple case.

Applexpander has two input sockets which can accept the usual two paddles, one joystick, light pen, or other input sensor as long as the device terminates in a Cinch Jones P-306 CCT plug. A full complement of such devices is available from CJM or the Jones plug may be installed on the cable of existing devices.

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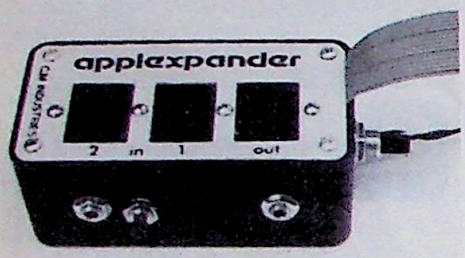
Extenders, continued...

Although a wiring diagram is provided in the back of the manual, we don't recommend doing this if it is your first construction project. If you have built at least one Heathkit, you'll have no trouble installing a Jones plug.

Input socket 1 is connected to paddle port 0 and 1, while input socket 2 goes into ports 2 and 3. These are not switched sockets; both are permanently connected. Five pages in the rather comprehensive manual are devoted to describing the operation of paddles and joysticks as graphics and game input devices. Five sample programs are included which demonstrate these concepts.



The "+ S" in the name of the device refers to "+ Speaker." Three twisted wires from the Applexpander are snaked through a cooling slot and are used to connect to the internal Apple speaker output and the speaker itself. Applexpander has a mini phone jack on the left front of the unit which provides for an external speaker to be plugged in. Additionally, Applexpander has a volume control which adjusts the volume of the internal or external speaker. If an external speaker is plugged in, the internal one is automatically turned off.

Although the Apple accepts input from four potentiometer devices, it only accepts three switch inputs through the game port. Assuming one has the CJM Microstick, switches 0 and 1 are located on it. However, for some applications it may be desirable to be able to trigger the third switch (SW2) without having another joystick or set of paddles. Applexpander provides this capability in the form of a small pushbutton switch on the case of the unit.

Located adjacent to the pushbutton for switch 2 is a mini-jack. The function of this jack is to allow an external switch to be read into the SW2 input. The switch and jack are in series. The jack accepts only normally closed switches, but any number of these external NC switches can be wired in series and plugged into the mini-jack. If one of the switches is thrown, then the Apple will read SW2 as thrown.

This type of system can be used for security. For example, a series of switches around the house can be wired in series and if any one of them is thrown, the Apple would "know" it and could turn on an output module through the control box described below which, in turn, could turn on an alarm.

Another application might be a "failsafe," in which the Apple is used as a controller. Tripping a limit switch would halt the Apple and the system would shut down with the Apple signalling a warning.

In addition to the input ports on the game I/O, the Apple also has four annunciator outputs. These outputs are controlled by "soft switches," which is the term used to designate an output which is switched on from one memory location and switched off from another. For example, for annunciator 0, memory location -16295 is the on switch and -16296 is the off. To throw the switch on or off, its appropriate memory location should be loaded with 00. This is accomplished with POKE (address) 00 from Basic or, from machine language, a LDA $300 then STA (hex address). These routines are fully described in the CJM Microsystem instruction manual.

You may be saying, "This is fine, but what's it good for?" By itself, not much. But with an additional relay control module, these output switches can be used to control a wide variety of household devices such as a video tape recorder, lights, security devices, hi-fi system, or anything at all that can be turned on or off. In other words, with the addition of a relay box, the Apple soft switch becomes a real-world hardware switch.

In summary, the Applexpander +S is the heart of the comprehensive CJM Microsystem. The rugged Jones plugs will probably last far longer than the Apple itself. Used only as an extender, the unit is somewhat pricey. However, considering the additional output and control capabilities, the extension speaker, and the access to switch 2 open up many new possibilities and put the CJM Microsystem into a unique niche in the market.

Sirius Joyport

(Review by Randi J. Rost.)

The Joyport is Sirius Software's first entry into the hardware field. It consists of a small plastic case about 6"x 4"x 1" that contains four I/O ports. The joyport serves as a game socket extension. In addition, it is an expansion to allow the use of two sets of Apple game paddles (with all four pushbuttons operational) as well as two Atari-type joysticks.

The Joyport user's manual is a 20-page document that contains several diagrams to aid in proper installation. The manual also contains instructions on using the Joyport and source listings of two example programs, one in Applesoft Basic and the other in Pascal.

Besides extending the game I/O socket, the Joyport also allows the Apple to recognize input from Atari-type joysticks. Two switches on top of the Joyport allow you to select which device (or devices) plugged into the Joyport will be active. One switch allows you to choose between activating the two Atari ports (front) and the two Apple ports (back). A second switch allows you to choose whether the left, right, or both ports are activated.

Before going any further let's set the record straight about some of the things that the Joyport cannot do. Most important, existing programs that use Apple game paddles will not work automatically with Atari joysticks once the Joyport is installed.

Games that use game paddles will be completely compatible with the Joyport when you use game paddles plugged into the Joyport. If you want to use Atari joysticks you must either modify your games yourself, or buy software written expressly for use with the Joyport and Atari joysticks.

Why hasn't someone come out with an adapter for the Atari joystick before now? Simple: the Atari joystick works on a completely different principle than Apple game paddles or joysticks. The Atari joystick consists of five switches, that's all. No potentiometer, just five switches. One of these switches is for the fire button, the other four represent the four cardinal points of the compass. If you push the joystick left, the "west" button will be depressed internally. If you push the joystick down and to the right, both the "south" and "east" buttons will be depressed. Diagonal movement is detected when two buttons are depressed simultaneously (e.g., up and left equals northwest.)

In order to obtain values for all five switches, the Joyport must be accessed twice. The first time, annunciator 1 is "off", (accessing location $C05A will turn it off) and the Joyport returns values for the fire, "east" and "west" buttons in the locations for pushbuttons 0, 1, and 2 respectively. Accessing location $C05B (turning annunciator 1 "on") will signal the Joyport to return values for the fire, "north," and "south" buttons in the same three locations.

Thus, to obtain values for all five buttons, first look at locations $C061-$C063 with annunciator 1 "off" to read values for the fire, "east" and "west" buttons. Then access locations $C062 and $C063 again with annunciator 1 "on" to get values for the "north" and "south" buttons.

As you can see, the Atari joysticks will behave much differently from Apple game paddles. They have absolutely no effect on the game controller locations ($C064-$C067) that are used to interpret the current paddle position. It is for this reason that existing software will not automatically run using Atari joysticks instead of Apple paddles.

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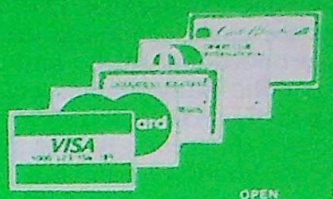

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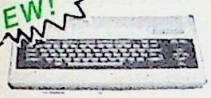

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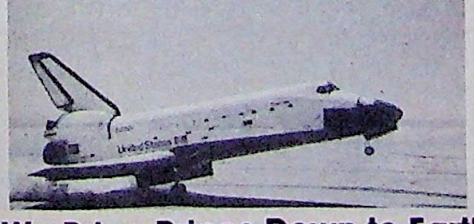

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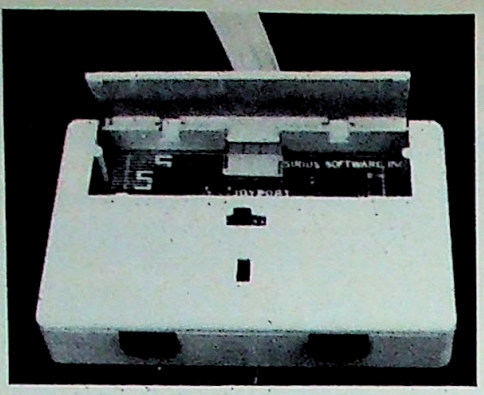
Extenders, continued...

Despite the incompatibility, the Atari joystick provides another distinct advantage: input can be obtained much more rapidly. This is because of the way the Apple paddle works. To read the paddle, the timing circuit is reset and all game controller locations are set high (they contain values greater than 127). The time it takes for each location to drop below 128 is proportional to the setting of the game paddle. Button inputs can be read with virtually no time delay.

Another difference is that the Apple paddle pushbutton locations will contain a value greater than 127 if the button is being pressed. The Atari joystick buttons cause just the opposite to take place: a value less than or equal to 127 signifies the button has just been pressed. This is a function of the Joyport. It ensures compatibility with the shift-key to pushbutton input two (pin 4) modification many users have made.

How does the Joyport work when the back switch is set to "both"? This position indicates pushbutton input should be accepted from both devices on the active side of the Joyport.

With the back switch set to "both," paddles 0 and 1 are obtained from the left side of the Joyport and paddles 2 and 3 are obtained from the right side. Turning annunciator 0 "off" (accessing location $C058) will allow pushbutton inputs on the left side to be read normally. Switching



it "on" (referencing location $C059) allows pushbuttons on the right to be read.

The Atari inputs are obtained a little differently. A second annunciator (number 0) must be "on" when input is to be read from the left side and "off" when input is to be read from the right side. The table shows all the combinations of this switch.

Software Compatibility

As you can see, a program must be written specifically to take advantage of the Joyport, or it must be modified to do so. I have succeeded in modifying a few of my shoot-'em-up games to accept input from the Atari joystick, and am quite pleased with the results.

Listing 1 shows the steps necessary to convert Creative Computing's *Super Invader*. You may wish to check the starting address of your version by typing: PRINT PEEK(-21902) + 256 * PEEK(-21901) after you have BLOADed the program. If the result is 512, you can follow the steps as shown in the table. If the address is 768, save the modified version by typing BSAVE INVADERS (JOYPORT),A768,L24100.

Sirius is currently marketing several games that may be played with an Atari joystick connected to the Joyport. These include *Gorgon, Copts and Robbers, Outpost, Hadron, Snake Byte, Twerps and Borg*. Gebelli's *Horizon V* may also be played with an Atari joystick by typing control-shift-p at the beginning of the game. Sirius has sent free Joyports to some of the major game publishers, including On-Line and Broderbund, in order to encourage development of compatible software.

The Joyport has a suggested retail price of $74.95 and includes a copy of *Computer Foosball* (1-4 players).

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Listing 1. Patch that will let you play Creative Computing's Super Invader *with an Atari joystick using Sirius Joyport.*

It should be emphasized that although the Sirius Joyport and Astar Octa Stick both accept input from a switch-type (Atari) joystick, they are not interchangeable (See Octa Stick review below).

Atari Mode Function Selection

Controller Select Switch Setting	Annunciator #1	Button 0 $C061 −16287	Button 1 $C062 −16286	Button 2 $C063 −16285
Left	On	Fire-1	Up-1	Down-1
	Off	Fire-1	Left-1	Right-1
Right	On	Fire-2	Up-2	Down-2
	Off	Fire-2	Left-2	Right-2

Controller Select In Middle

Annunciator #0	Annunciator #1	Button 0 $C061 −16287	Button 1 $C062 −16286	Button 2 $C063 −16285
On	On	Fire-1	Up-1	Down-1
	Off	Fire-1	Left-1	Right-1
Off	On	Fire-2	Up-2	Down-2
	Off	Fire-2	Left-2	Right-2

Atari mode function selection. With the annunciators and the controller select switch of the Joyport set as shown, locations $C061-$C063 will indicate a movement in the specified direction.

Astar Octa Stick II

The Octa Stick II is an interface for using an Atari-type joystick with an Apple. As mentioned above, this type of joystick is either completely on or off in a direction and, if pushed diagonally, can activate two switches.

The heart of the mechanism is a small interface consisting of a 16-pin DIP plug, a male receptacle for a DE-9 Atari joystick plug, some resistors and relays and two trim potentiometers.

Since this type of joystick returns only three values in each of two directions (center, up, down or center, left, right), the center value may have to be adjusted so it does not look to the program as though the joystick has been pressed. "Normally" the three values returned are 0, 127, and 255. However, a program written for both continuously variable as

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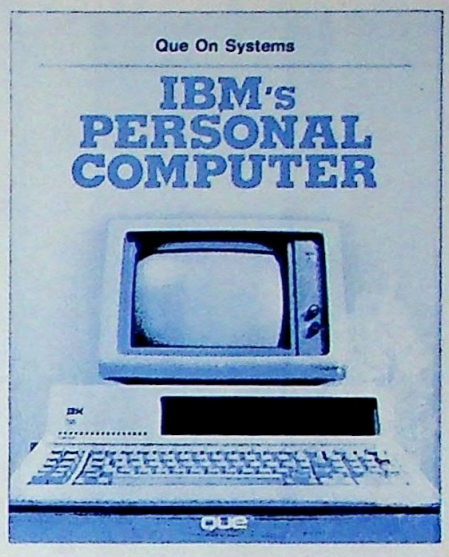

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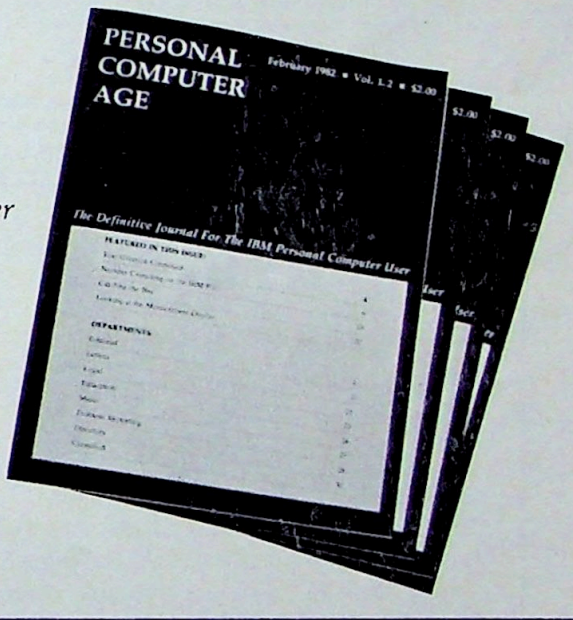

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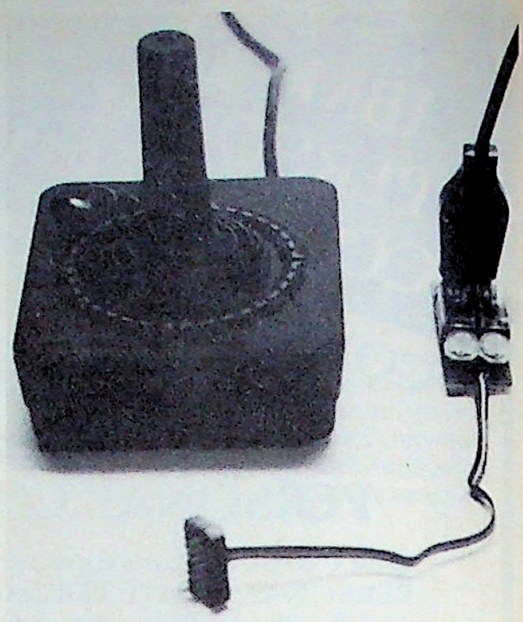

well as switch-type joysticks may be written to accept the values 100, 120 and 140 indicating directional movement. For a program of this sort, it may be necessary to adjust the center (off) value of Octa Stick.

It should be emphasized that although the Octa Stick interface and Sirius Joyport both accept input from a switch-type joystick, the output to the computer is quite different. Octa Stick puts out three resistance values which can be thought of as simulating the left, middle and right position of a potentiometer-type joystick. Games written for the Sirius Joyport cannot be used with Octa Stick while games like *Thief* and *Snack Attack* work well with Octa Stick but not the Joyport.

The Octa Stick II interface has a sticky back permitting it to be mounted on the side of the Apple. Unfortunately, the cable is only six inches long which means that if Octa Stick is one's only interface, it must be mounted well to the back of the Apple case. However, if it is used in conjunction with an extension port it can be mounted toward the front right of the case.

In summary, we found the Octa Stick interface with a Newport or Atari joystick considerably better than potentiometer-type joysticks for playing the Pac-Man and Berzerk families of games.

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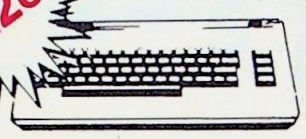

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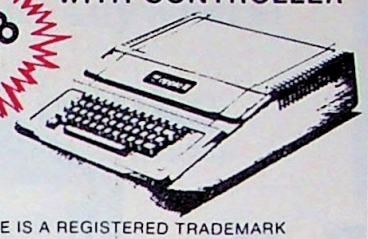

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CIRCLE 121 ON READER SERVICE CARD

Sing for Your Buffer

John Anderson

Giving microcomputers the power of speech is no mere frill or gimmick. The potential of such a capability, for the handicapped as well as microcomputer users at large, is dramatic.

For as long as microcomputers have been around, the cost of such potential has remained a prohibitive factor. But that is changing fast, as is the sophistication of the hardware.

There is a new entry on this front from the Street Electronics Corporation, called the Echo GP. Echo does the job well, and has some unique capabilities.

It is based on the Texas Instruments TMS 5200 speech processor chip. This is in contrast with its nearest competitor, the Votrax Type-n-talk, which uses the Votrax speech chip.

The unit makes use of its own 6502 microprocessor, and interfaces as if it were a printer. It is available in RS-232 serial or Centronics parallel versions. We made use of the serial version, and hooked it up for use through Logo on the Apple II, and Basic with the Atari 800.

Upon power-up, the Echo unit responds with the phrase "*Echo* ready." One of the first features the user will notice is that the Echo is capable of intoning a sentence; rather than speaking in monotone, the pitch of voice is dynamic. This makes for a more intelligible and less grating speech quality.

You can use the internal speaker of the unit or route the sound to an external speaker. I found it convenient to use an earphone when working on speech editing sessions.

Textalker is the ROM based program Echo uses to convert English text into speech. Echo can read English text directly, with a pretty low error rate. It should be noted that even when Echo mispronounces a word or syllable, the listener can usually make sense of the sentence from its context.

This is not to say that Echo has the diction of Henry Higgins. In fact, it takes a bit of time to become accustomed to the unique "accent" of the unit. It has trouble with the "g" sound in words like "go," and "l" sounds give it problems as well.

In this respect, the voice of the Votrax unit wins out. Though it also has its share of vocal peculiarities, it does on the whole have better enunciation than the Echo. And yet, for extended periods, I would rather listen to the Echo. The monotone of the Votrax really gets me down after a while. Too "computerish," I guess. It's too bad, because the Votrax chip itself does allow for software control of pitch. But that's another story.

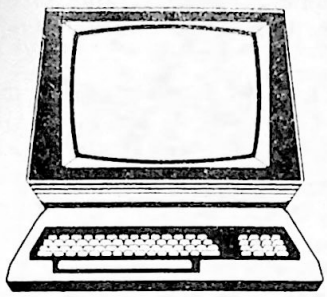
Accessing Features

The features of the Echo are accessed through control characters. For instance, pressing control-e enables the Textalker commands. Following this character with a number from 1 to 63 determines the pitch of Echo voice, which can be toggled from "f" (for flat, meaning unintoned), to "p" (for pitched, meaning intoned). I found that the Echo could be programmed to "sing" through careful use of these commands. In fact, the unit provides for about three octaves—not a bad range. A pitch table and sample program appear in Figure 1.

In this mode, intonation can also be controlled by punctuation of the text. A

		Do	Re	Mi	Fa	So	La	Ti	Do
Octave 1	-	12	15	18	20	23	26	29	31
Octave 2	-	31	34	37	39	44	48	51	53
Octave 3	-	53	56	58	61	63			

Figure 1. A rough pitch table to give the synthesizer a singing voice. Flats and sharps can also be supported, but I have not taken the time to locate them.



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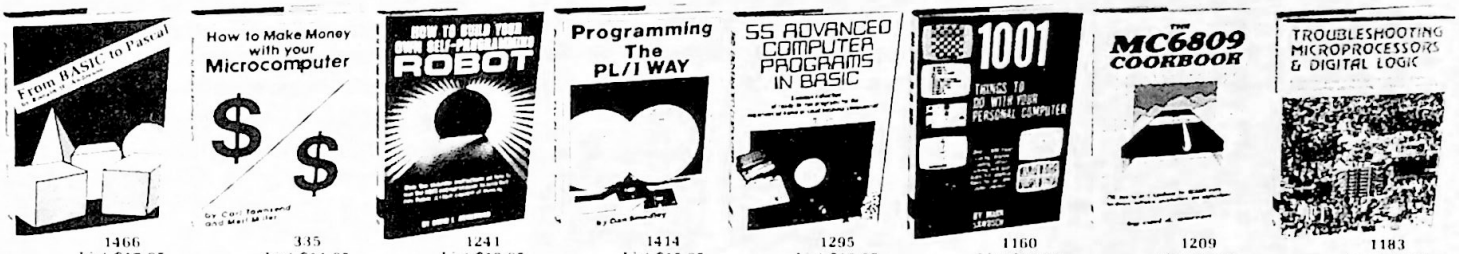
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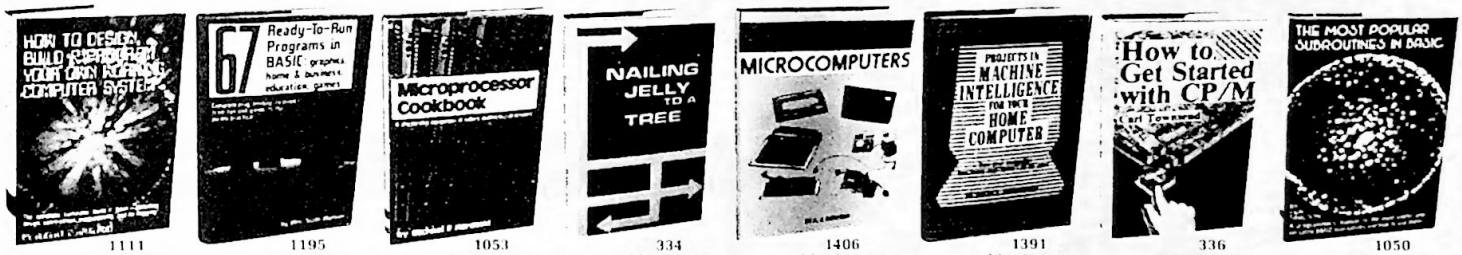
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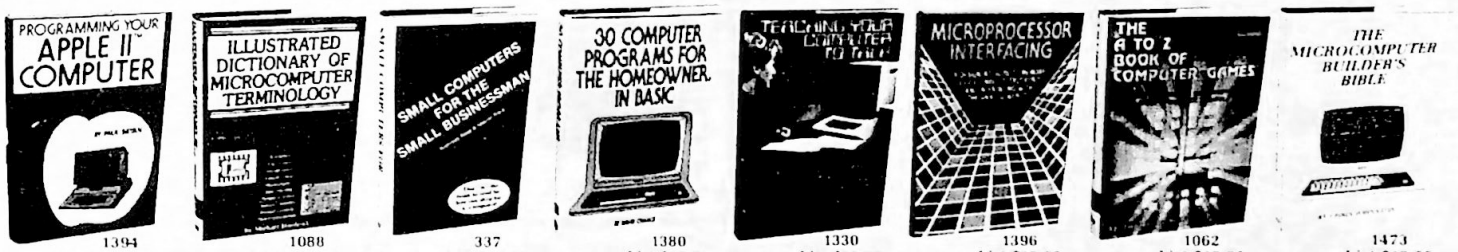
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CIRCLE 187 ON READER SERVICE CARD

```
10 REM ECHO SINGS ITS HEART OUT
20 REM ASSUMES SERIAL PORT IS OPEN AND CONFIGURED
30 DIM I$(100)
40 READ I$
50 IF I$="STOP" THEN STOP
60 PRINT #1,I$
90 GOTO 40
1000 DATA ↰12F
1010 DATA SOME
1020 DATA ↰31F
1030 DATA WHERE
1040 DATA ↰29F
1050 DATA OAV
1060 DATA ↰23F
1070 DATA ER
1080 DATA ↰26F
1090 DATA THE
1100 DATA ↰29F
1110 DATA RAIN
1120 DATA ↰31F
1130 DATA BOW
1140 DATA ↰12F
1150 DATA SKIES
1160 DATA ↰26F
1170 DATA ARE
1180 DATA ↰23F
1190 DATA BLUE
1200 DATA STOP
```

Figure 2. With a singing synthesizer your micro won't be in Kansas anymore. The character "7" is what control-e looks like on the screen.

comma creates a pause, a period causes a drop in pitch at the end of a sentence, and a question mark results in a rise in pitch.

Textalker can also be switched into a punctuation mode, wherein it pronounces each punctuation mark it encounters. Similarly, the user may choose to have all upper case letters pronounced as letters (use this mode to get "IBM" to sound right), or to have all words spelled out letter-by-letter.

The rate of speech may also be compressed, resulting in twice the text in the same time frame. Remarkably, this function sometimes increases rather than decreases the understandability of certain sentences.

According to the documentation, the Textalker component of the Echo GP "contains close to 400 rules which allow it to correctly pronounce 96% of the thousand most commonly used words in English."

I was pleasantly surprised at how well Echo did with unaltered English text. Having worked with phonemically-based speech synthesizers in college, I realized this was quite a feat. Of course there are some words with which the Echo has trouble.

Fortunately, an appendix, which outlines the kinds of fixes to apply to these words, is provided. The fixes are as simple as the addition of a space, such as "create" for the word "create," or the respelling of "question" as "kwestchun."

In addition to the Textalker module, speech can be programmed at the phonemic level, using a module called the "Speakeasy Phoneme Generator," also resident in firmware. This mode is selectable by the character control-v, and provides for much more detailed control. Stress, pause, pitch, volume and rate

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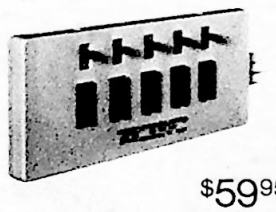

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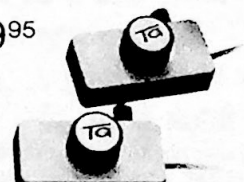

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CIRCLE 192 ON READER SERVICE CARD

controls can be written directly into the text strings, allowing for much more natural sounding speech.

This approach requires the use of a phoneme code, provided in the documentation. It bears little resemblance to any phonetic alphabet I have come into contact with, but the 48 phonemes it provides more than cover the sounds you need to create intelligible English speech.

Unfortunately, the time it takes to achieve satisfactory results using this approach is somewhat unreasonable, especially in contrast to the serviceable job Textalker provides. However, budding linguists should take note. The phonemic mode offers great potential for experimentation. I had the unit speaking a little German.

The Echo GP lists for $369.95, which seems a bit stiff. Still, it is comparable to the price of the Votrax Type-n-Talk. And if you want to have your micro singing Rodgers and Hammerstein, the Echo is the logical choice.

Street Electronics Corp., 1140 Mark, Carpinteria, CA 93013. □

CIRCLE 316 ON READER SERVICE CARD

Connecting the Echo

In March of 1982, *Creative* ran a review of the Echo Speech Synthesizer board for the Apple II. At that time, Textalker and Speakeasy were in the development stage. The GP offers much greater flexibility and power, as well as the capability for connection to any microcomputer.

However this does not automatically imply *easy* connection. Even with our experienced "think tank" here at the magazine, it took us a while to make the Echo conversant with an Atari computer.

Male DB-9 (to serial port #1) - Male DB-25 (to Echo GP)

Pin 1 No connection
Pin 2 No connection
Pin 3 Connects to pin 3
Pin 4 Connects to pin 2
Pin 5 Connects to pin 7
Pin 6 Connects to pin 20
Pin 7 Connects to pin 5
Pin 8 Connects to pin 4
Pin 9 No connection

Figure 3. Wiring a cable for connection to the Atari 850.

The 850 interface is required in order to provide the Atari with a serial port, and unfortunately, the documentation accompanying the 850 provides beginners with quite a run for their money. Here's a way to do it.

The first thing to do is make an interface cable, by wiring up a DB-9 male to DB-25 male connector. The pinouts given in Figure 3 work with serial port number 1 on the 850.

Next you must configure the Echo and serial port number one so that communication may be established. I used a data transfer rate of 1200 baud. This entails setting the DIP switches on the bottom of the Echo so that positions 1 and 2 are on, while position 3 remains off. Position 4 also remains in the off position, to enable "handshaking," as we say in the trade.

The serial port is configured through software. Figure 4 shows an example of this configuration, as well as a short program allowing for straightforward experimentation with the unit.

Make sure the 850 device handler is booted when using the GP. This occurs as an "autorun.sys" file on the Atari DOS diskette. It should be resident on any program diskette for use with the unit. Power up the 850, then boot a disk with the handler file. You'll be all set to go.

```
10 OPEN #1,12,0,"R1:"
20 XIO 36,#1,10,6,"R1:"
30 DIM I$(100)
40 I$="▯15P HI THERE. THIS IS ECHO G P.,, READY
   WHEN YOU ARE.,, OVER."
60 PRINT #1,I$
70 INPUT I$
80 PRINT #1,I$
90 GOTO 70
```

Figure 4. It is this simple to configure serial port number one and input text for synthesis. Again the "▯" character signifies control-e. Don't forget to boot the device handler prior to running the program.

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Video Games Update

Danny Goodman

Signs and banners throughout Chicago's McCormick Place on June 6, 1982 proudly announced the Summer Consumer Electronics Show (SCES), a mammoth trade-only exposition of electronic gadgets ranging from $10 digital watches to home audio/video systems pushing $25,000. But this year, most of the 70,000 or so visitors to SCES would agree that the show was incorrectly named. It was really the Summer Video Games Show (SVGS).

Even veteran game industry watchers were having trouble keeping up with all the new hardware and software companies and the designs of dozens of cartridges for the popular Atari VCS and Mattel Intellivision video game systems.

Pre-Show Warm-Up

As recently as January, it had been easy to get a handle on the industry. Hardware—game console—brands were the same as they had been for a couple of years: Atari, Mattel, Odyssey, and Bally's Professional Arcade under Astrovision's care (their name has since changed, as we'll see).

On the cartridge end, only a few outside companies were on the scene, trying to fill the slots in an estimated 6 million Atari VCS consoles. Activision had started the idea of supplying cartridges as a third party supplier (i.e., cartridges not made by the console manufacturer) in 1980.

January 1982 saw a few new brands trying to get in on Activision's successful act. Games by Apollo and Imagic demonstrated a total of five Atari-compatible cartridges in various stages of development. And Coleco announced, but did not display, 9 Atari and 11 Intellivision games due later in the year.

Danny Goodman, 275-B Island View Lane, Barrington, IL 60010. Source number: ST 0450.

Then came the Toy Fair in New York in February, and more action. Parker Bros announced Atari cartridges, as did CBS/Gabriel and even arch-rival Mattel. Coleco did one better: in addition to the cartridges announced earlier, a completely new console system was shown for the first time.

Since then, more new products than you can shake a joystick at have surfaced. The SVGS brought to light prototypes or announcements of about 90 new Atari-compatible games (by my count) from 17 companies, if you include Atari. Lots of new names, too: Arcadia, CommaVid, Data Age, Fox, MCA, Spectravision, Telesys, Tiger and Vidtec.

And then there was a parade of new console systems, like working versions of Atari's new 5200 advanced system and Colecovision. Astrovision renamed both the company and its old Bally system to Astrocade. Entirely new systems by Emerson, Video Technology of Hong Kong, and General Consumer Electronics (GCE), kept show goers busy zapping and beeping.

Now, on to a catalog of details and some first-hand impressions from the 1982 Summer Video Games Show.

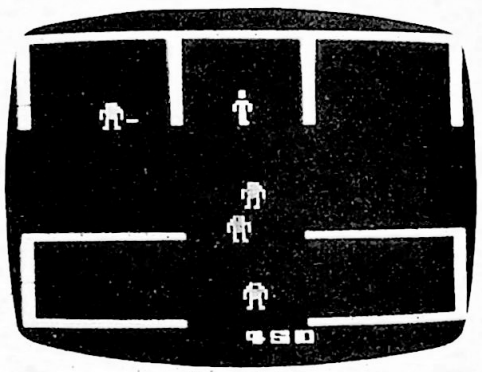
Atari VCS Action

The company that started the Atari craze was present with several new cartridges for the VCS, as well as with plans for even more in 1983.

Arcade themes on display were limited to previously announced Defender and Berzerk: the first, a wonderful VCS adaptation of one of arcade-dom's most complex and macho favorites; the second, a graphically faithful reproduction that is rather uninteresting in play value.

There was a noticeable emphasis on video adaptations of adventure type games. That's adventure with a small "a"—what I saw bears little resemblance to Atari's popular Adventure cartridge. One series is under the SwordQuest banner, and will be supported by clue-filled comic books designed for each cartridge by DC Comics.

EarthWorld, the first to become available in October, features 12 zodiac rooms with doors containing clues for the hunter. Action sequences are thrown in to add to the difficulty. Experience in EarthWorld is said to prepare you for the second release, FireWorld, in November.



Berzerk.

Two more games, AirWorld and WaterWorld, feed on your knowledge of the first two, and are scheduled for 1983. This series will appeal to the dedicated video gamer—or may convert dyed-in-the-wool fantasy role-playing gamers to video games.

Another adventure style game, due in December, will be based on the movie *Raiders of the Lost Ark*. Atari is promising to pack this cartridge with a new computer coding scheme that crams more graphic detail onto the screen than we have seen before. In this game, we will be guiding Indiana Jones on a treachery-filled trek through 13 rooms to recover the lost ark of the covenant.

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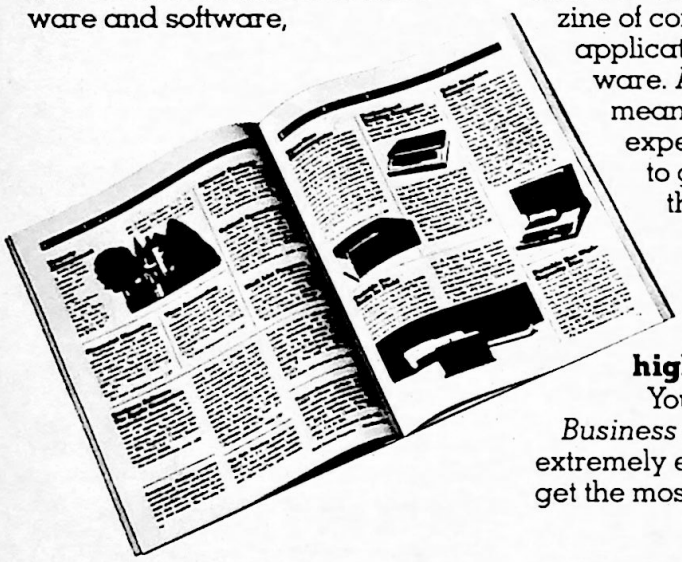

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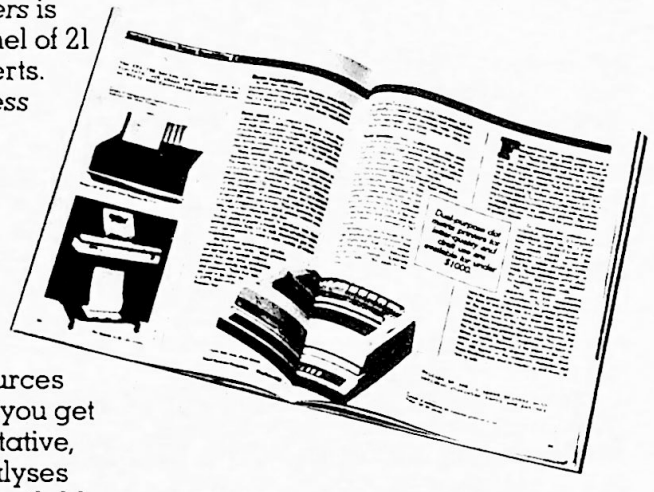

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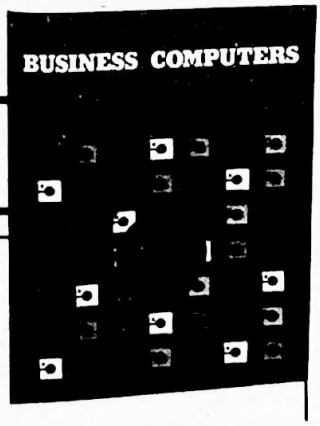

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Coleco Cartridges.

Coleco Cartridge Collection

At the heavily guarded Coleco booth, only one of the company's nine Atari-compatible cartridges was on display—and a very interesting display at that.

Set up side by side were Coleco's three versions of the same game, Donkey Kong—in Atari cartridge, Intellivision cartridge, and Colecovision cartridge forms. Although I probably could have spent an hour comparing the three, my initial reaction is that the Colecovision takes the top prize in arcade realism (see Colecovision report below), followed surprisingly by the Atari and Intellivision, in that order. In this case, arcade realism is judged not in terms of graphic resolution, where, of course, Intellivision beats the VCS by a mile, but in terms of pleasing reproduction. Looking at the two screens, the VCS was more inviting. If Coleco does as well with the other VCS cartridges (Venture, Cosmic Avenger, Mouse Trap, Lady Bug, Carnival, Smurf, Zaxxon, and Turbo), there could be some tough decisions to make at the cartridge counter.

New Kids On The Block

All sorts of new company names surfaced on the Atari-compatible front.

Vidtec is a new brand offered by U.S. Games Corporation, which is a newly acquired subsidiary of the Quaker Oats Company. Got that? If not, don't worry. Vidtec is the name that will appear on the cartridges. The announced opening library is a collection of eight varied titles, practically all dedicated to family play, rather than ultra-macho themes.

Two are intended for the very young. Sneak n' Peek is a video hide-and-seek with interesting cartoon graphics of rooms inside a mansion. Word Zapper is a clever educational game that combines a memory/spelling drill with a shoot-'em-up arcade game.

No manufacturer's library can be without a space game, and Vidtec's is Space Jockey, previewed at the January Consumer Electronics show. In this one, you are the space ship, fending off helicopters, balloons, planes, and ground tanks scrolling at you horizontally across the screen.

Commando Raid is another shoot-'em-up, with parachuting commandos trying to land and capture your ground gun. Weird Bird is a Kaboom variation, in which you must catch falling eggs before they splat. But you also have a chance to shoot at the birds.

Other Vidtec titles include Towering Inferno, Gopher Attack (they could have used this game and its Gopher Bonker in the movie *Caddyshack*) and Maze Chase.

A Tiger In Your VCS

A fast-paced maze game called Jawbreakers (licensed from On-Line Systems) is one of five titles introduced by Tiger Electronic Toys' new Tigervision line of cartridges. You may have seen Apple and Atari computer versions of this game, but the VCS version is much different. In this one you control candy-bar-eating teeth (like the wind-up clattering novelty) up, down, and across a series of fast-moving horizontal lanes. Occasional breaks in the lanes let you jump from one to the next as you try to avoid smiling faces (like Berzerk's Evil Otto) that race down the lanes after you. When you clear the screen of candy bars, you pause while a colorful toothbrush comes out to keep you cavity-free.

The balance of the library includes King Kong (licensed from the movie, and reminiscent of Donkey Kong in play), River Patrol, Marauder (robots in a maze) and Threshold (a space fight game).

CommaVid is another new name on the cartridge scene, presenting four new games for the VCS: Cosmic Swarm, Room of Doom, Mission Omega and Mines of Minos.

Cosmic Swarm is an appealing game because there are several things going on at once—a combination of strategy and shoot-'em-up skill is needed. The instructions relate an overly detailed and unnecessarily confusing scenario for the game, in which "metal-munching termites" crawl out from the top of the screen at random, each carrying a square block. They lay these blocks at random around the play area.

You are in command of a small space fighter (with Asteroids-like rotation and thrust movement, but no hyperspace) charged with keeping the play area clear. To do this, you must hit a block in a very precise spot, while a termite is still carrying it. All the blocks on the playfield then turn from green to red. While they are red (energized), your laser can destroy them one-by-one. But if a termite should start after you (and it will!), you may be forced to shoot it in self-defense, which will cause all blocks to turn back to the impenetrable green.

As soon as you think you have everything under control, you hear a buzzer that warns that you need to refuel by docking briefly with a fuel ship which appears along either the left or right screen edge. This gives the termites time to lay more blocks.

If the termites succeed in building a wall of green blocks between you and the fuel ship, you are in big trouble. The game will not win any awards for graphics, but the action-strategy combination makes Cosmic Swarm a likely prospect for your VCS library.

The Movies Go To Video Games

In an apparent "can't lick 'em, join 'em" move, three large entertainment companies who had feared erosion of movie and television audiences to video games, launched video game efforts of their own. At the show, MCA (parent of Universal Pictures and Universal Television) simply announced that MCA Video Games Inc. will develop cartridges "in all systems for the home market." We can expect many titles to bear likenesses to action movies and TV shows, but releases won't come until 1983. They are also looking into game possibilities using the capabilities of the laser videodisc—an exciting prospect, indeed.

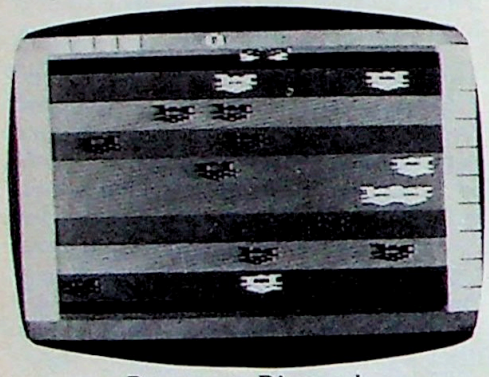
A more concrete announcement came from CBS, who will issue cartridges through CBS Video Games, a division of CBS's Gabriel Industries (the toy and game maker). In CBS's hip pocket is an arrangement with Bally, whereby CBS will have the video and computer game rights to new Bally arcade games for the next four years. Two Atari-compatible cartridges should be out this year (probably Wizard of Wor and a four-screen version of Gorf), with more cartridges and other game formats to follow in 1983.

If Warner and MCA can do it, so can Twentieth Century Fox, with its new company called Fox Video Games. Four brand-new games developed by veteran computer game creator Sirius Software were on display: Deadly Duck, Beanie Bopper, Worm War I, and Fast Eddie. Of the four, Worm War I and Fast Eddie should appeal most to the experienced gamer.

Sports fans will see a series of redesigned sports cartridges: Baseball (October), Volleyball (November), Football (December) and Soccer (early 1983). Only Baseball was on display—or rather, just the screen of the new field and players. It was, indeed, an improvement in graphics over the first generation. Actual game play has yet to be seen, but will surely be a welcome addition for sports-starved VCS players.

Younger players will probably enjoy a frogs vs. flies game tentatively titled Frog Pond (November). Two frogs vie for the highest number of flies by jumping and catching the insects with their tongues. If you have seen Intellivision's Frog Bog, you get the picture.

Other Atari-made games introduced included Demons to Diamonds (an average activity that is a cross between Space Invaders and the arcade Centipede on an old Atari Football field), Fail Safe (tank battle) and a VCS version of Atari's outstanding 400/800 computer game, Star Raiders.



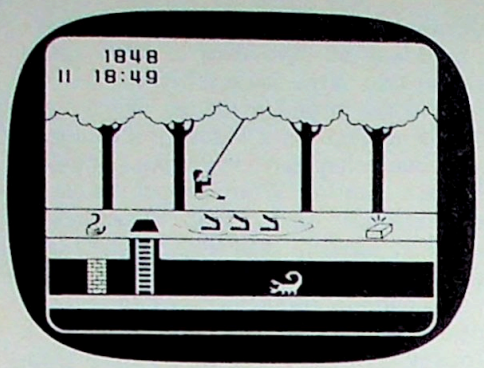
Demons to Diamonds.

Star Raiders.

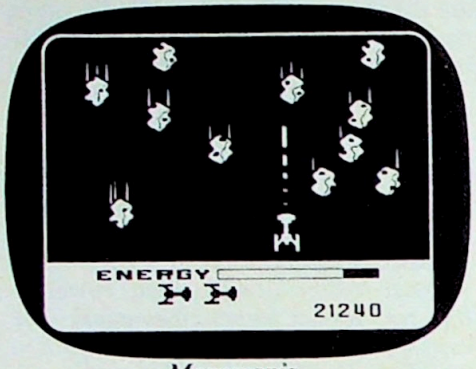
Activision Activities

I doubt that there is an active VCS owner who doesn't have at least one Activision cartridge in his library—probably Freeway or Kaboom. Well, move over guys—here comes another very original cartridge no VCS should be without: Activision's Pitfall!, subtitled, Pitfall Harry's Jungle Adventure.

Your job is to guide Pitfall Harry through a series of danger scenes (256 different ones, I heard) in search of



Pitfall Harry's Jungle Adventure.



Megamania.

treasures, while dodging any number of hazards. You need coordination to grab and swing on a vine across tar pits, jump over logs, walk through swamps by carefully stepping on closed-mouth crocodiles ...and on and on.

Underground passageways may help, until a scorpion or brick wall gets in the way. Graphic detail is startling for the plain ol' VCS, and the play is not something easy to master—the time limit for a search is twenty minutes. Amid all the Atari-compatible cartridge hoopla at the show, this game was a standout.

Activision's other Atari introduction, Megamania, is called a Space Nightmare—but it's more like a Space Invader's Nightmare. Instead of fighting off descending alien creatures, you must shoot at colorful objects like hamburgers, radial tires, dice, irons, bow ties, etc., as they descend to the bottom of the screen. One extra game element is an energy gauge, which runs out if you let too many "invaders" reach ground level.

Imagic Graphic Magic

Imagic, makers of the graphically well-executed Demon Attack, continued to demonstrate its graphics prowess with four interesting-looking Atari cartridges. On the space front, Atlantis displays a detailed underwater city under attack by various spacecraft.

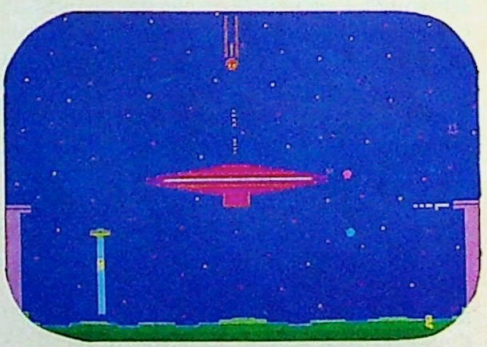
You start out with three lasers on the screen—one in the center shooting straight up, and one on each side of the screen shooting diagonally across the screen. The joystick selects which laser you want to fire at the spacecraft flying by, and the red action button shoots. Of course, the aliens are not passive: they are trying to bomb your lasers and other Atlantis targets. Reaching high score levels helps replenish your destroyed installations.

Offering more intriguing game play is Imagic's new Cosmic Ark, alternating two-part space encounter. Scene One puts you in charge of the Ark, a large space ship in the center of the screen. Enemies attack from each of four sides. You must respond quickly by moving the joystick in the direction of the on-coming missile and shoot.

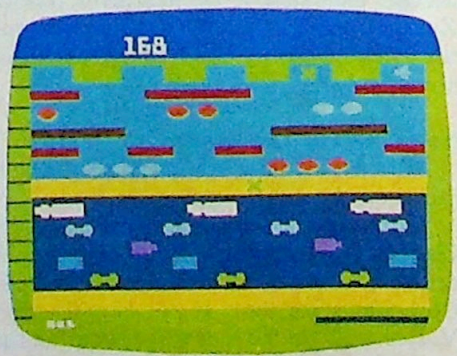
Once through a wave, the scene changes to a planet surface. The Ark descends partially. While it hovers, a smaller roving craft disembarks on a time-limited challenge to beam up two of the critters on the planet (Ark, get it?).

At higher levels, this becomes difficult as a deadly ram beam scans over the planet surface seeking aliens such as you. A buzzer sounds, and you must high-tail it back to your mother ship before a

Atlantis.



Cosmic Ark.



Frogger.

meteor comes crashing out of the sky to obliterate your only means of escape. In many ways, this is a turning-of-the-tables on the Defender theme. And it's a winner.

Another Imagic creation features an adventure type game set in the Egyptian Valley of the Kings, called Riddle of the Sphinx. You will need some time to learn how to recognize all the characters and their powers or threats.

Fire Fighter is fun to watch, and will probably delight the kids. The scene is a burning high rise building with a frantic woman running from window to window just out of reach of the inferno. As the firefighter, you put the fire out with your hose and maneuver a hook and ladder to rescue her in the shortest time possible.

Parker Bros, the people who bring you Monopoly and Merlin, are also setting sights on your VCS console slot with a growing series of cartridges based on either popular arcade games or other licensed properties.

The Empire Strikes Back—a game that takes some getting used to before you feel challenged—and a remarkably true-to-arcade Frogger are the first two titles. They will be available by the time you read this.

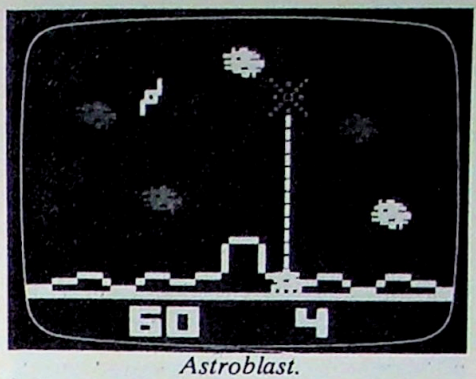
There is always a hazard in trying to reproduce a well-known, high-resolution arcade game on the low-resolution Atari VCS (or any system using a color TV as a display), but Frogger is one of the most detailed translations I have seen. The most noticeable difference in game play is that you have the advantage of a wraparound screen. If Frogger is on a log moving to a screen edge, he will reappear unharmed on the opposite side of the screen.

Announced, but not on display in VCS form, were upcoming Parker cartridges for Amidar (both playfields are planned), Super Cobra, Tutankham, Reactor (this will be a VCS designer's challenge, to be sure), Sky Skipper, and a Spiderman adventure.

Mattel and Atari

One of the industry surprises this Spring was Mattel's announcement of its intention to produce cartridges for the Atari VCS. At the SVGS, I had an opportunity to see screens of the initial library of eleven games in Mattel's M Network series. All cartridges parallel already successful Intellivision cartridges or ones about to be released. Most of the names are changed on the M Network versions.

For example, Astrosmash is Astroblast for the VCS. Game play is identical. I thought it would be easier using the Atari paddle controllers than the Intellivision direction disk. But, with only a few minutes of play time, I found it not as



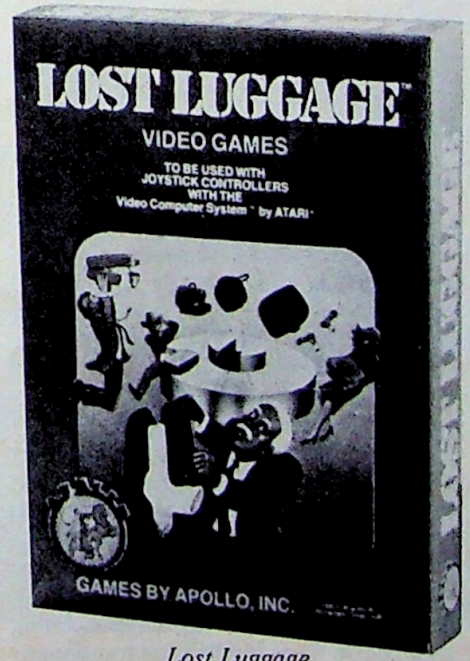
Astroblast.

easy to advance to higher levels—possibly because the falling objects come faster than on the Intellivision version. In any case, this and other Intellivision translations will be welcome library additions for those who were torn between the VCS and the Mattel system and chose the VCS.

The remaining cartridges (with Intellivision parent title in parentheses) are: Space Attack (Space Battle), Super Challenge Baseball (Major League Baseball), Super Challenge Football (NFL Football), Armor Ambush (Armor Battle), Frogs and Flies (Frog Bog), International Soccer (NASL Soccer), Lock 'N' Chase (same), Dark Cavern (Night Stalker), Sea Battle (same), and Tron Deadly Discs (same).

Taking a purely original game design route is Games by Apollo. On display were four new cartridges: Lost Luggage, Racquetball, Shark Attack, and Space Cavern.

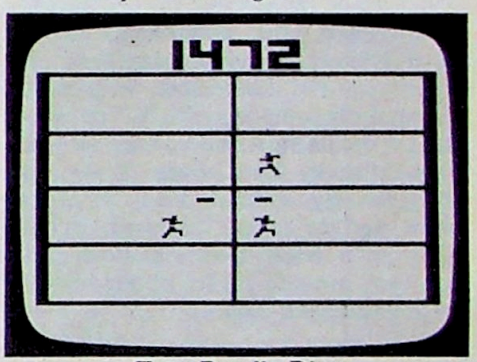
Lost Luggage has a cute story line: an airliner lands, and shortly thereafter, luggage starts coming around the baggage claim carousel. But it's running too fast, and luggage goes flying everywhere. You must catch all the pieces before they hit the ground. If one hits, they all open (like Kaboom's bombs going off) with various personal articles, ranging from combs to brassieres, falling to the ground. Each "wave" is a new planeload of luggage.


LOST LUGGAGE
VIDEO GAMES
TO BE USED WITH JOYSTICK CONTROLLERS WITH THE Video Computer System by ATARI
GAMES BY APOLLO, INC.

Lost Luggage.

The graphics are fun to watch, but the game play for experienced players gets old fast. Your screen character, which can move up and down as well as across the screen, has too large an area (about half the screen) to cover for a very random assault of luggage. This cartridge falls into a rapidly growing category of games intended for a broader, family audience.

Super Challenge Baseball.



Tron Deadly Discs.

Racquetball takes a difficult-to-reproduce game and makes it almost impossible to play. To help you determine the position of the ball in the enclosed court, you have two ball shadows—one on the floor, one on a wall. From only brief play at the show, I never felt in control of my screen player, as far as getting him lined up to take an automatic swing at the ball. Most of my points were scored by accident. Action games like this should be a little easier to get into.

Worm War I, written by former *Creative Computing* Associate Editor David Lubar, is a raucous venture down a dark, vertically scrolling playfield. Colorful side barriers provide a feeling of movement. Waves of worms come into view in images reminiscent of a Star Trek transporter materialization and wriggle like inch worms across the screen, as they scroll toward the bottom of the screen. Worms you don't shoot reappear at the top of the screen in a different color.

The "catch" is that you have limited fuel (displayed as an ever-decreasing

number) which can be replenished only by speeding through gas stations that appear at random amid the materializing worms and barriers.

The more momentum you get before going through the garage, and the more accurate your aim through the opening, the more energy you collect. Garages, however, are frequently surrounded by the worms and barriers you are trying to shoot. Errant shots destroy the gas station—and your chance for a recharge on that wave.

Fast Eddie at first looks too cute to be a serious game. Eddie is faced with five floors connected by ladders. On each screen, Eddie must jump to grab nine objects without being touched by creatures, called Sneakers, which vigilantly patrol each floor (you can jump over Sneakers, by pressing your fire button).

Objects appear only two at a time, and replacement objects appear at random forcing Eddie (you) to climb up and down to all levels to pick up enough objects. By the time you grab the ninth object (the points for each successive object flash for a second where the object originally appeared on the screen), the one Sneaker, called High Top, who guards the top floor, is short enough to jump over.

Get your Fast Eddie up to the top floor, successfully jump over High Top, touch the key he carries, and you are on to the next difficulty level. Each of the eight progressively difficult levels (featuring more and/or larger Sneakers making jumping a trick) contains five or six screens—providing a lot of play time for the experienced player.

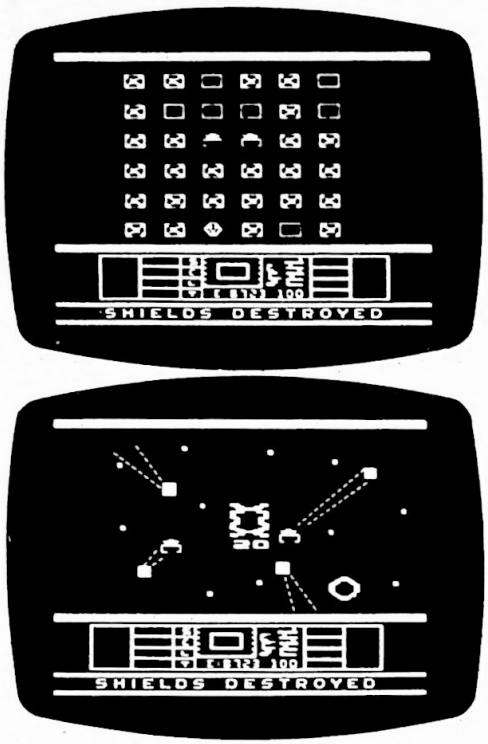
Improved VCS Graphics

If I had not seen it with my own eyes, I would not have believed that the Atari VCS could be "supercharged" with a plug-in device to increase graphic resolution. But Arcadia Corp. sure seems to have done it. Moreover, the games are contained on low-cost audio cassettes, loaded through a tape player.

Arcadia's Supercharger ($69.95, including one cassette) looks like an extra-long game cartridge that plugs into the slot on the VCS console. A wire coming from the Supercharger case goes to the earphone jack of a cassette player. Taped programs ($14.95 each) load into the expanded RAM of the supercharger (6272 bytes vs. 128 bytes in the VCS) just like a microcomputer program.

The additional RAM enlarges the amount of screen/graphics information that can be stored (or "dumped," if you will) onto the TV tube. It allows, in the end, the graphics generator to scan every line of the TV screen, instead of repeating an image for two lines, as the VCS does by itself. The balance of the RAM is left for program instructions which normally come from the plug-in ROM cartridges.

The graphics are something else. On one tape, Phaser Patrol, you are in a Star Raiders/Starmaster environment, with two screens of action: a galactic sector map and a cockpit action screen. But it is the detail of the instrument panel that shows how much improved the resolution is. Small letters and numerals are easily readable, and a fascinating clock has very small, yet distinct elements.



Phaser Patrol.

I also saw some scenes from a maze game that was still under development. The view was that of walking down corridors. Diagonal lines receding into the distance were among the smoothest (i.e., little noticeable "stair-stepping") I have seen on any home video game system.

The Phaser Patrol cassette is shipped with the Supercharger. Other titles announced are Communist Mutants From Space (a Space Invaders variant), Fireball, and Suicide Mission.

Intellivision News

If you are the proud owner of Mattel's Intellivision system, don't be discouraged by what seems to be trainloads of support only for the Atari VCS. Apparently, there are enough Intellivision consoles in use to attract several independent cartridge designers.

Activision, the multi-award winning developer of many of the most captivating cartridges for the VCS, featured two Intellivision adaptations of their Atari titles: Stampede and the new Pitfall! (see review above).

I had expected to see some dazzling graphics for these Intellivision translations—but such was not the case. In Stampede, for example, the cowboy/horse and "dogies" were scarcely more detailed than their Atari ancestors. And in Pitfall!, where the Atari version went to great lengths in exploiting graphic detail, the Intellivision screen offers only a couple of readily discernible refinements.

In conversation with Thomas Lopez, Activision Vice President of Editorial Development, I learned that the intent of these two cartridges was simply to bring the game play of two top Activision games to Intellivision users—games they would otherwise not be able to play. He assured me, however, that the company was at work on original Intellivision cartridges that will take advantage of the graphics capabilities of the system.

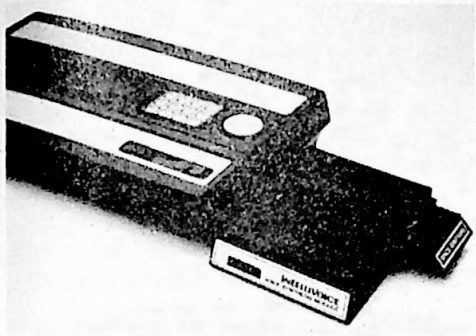
Over at Imagic, exciting things were happening with Intellivision cartridges. Their popular Demon Attack has been translated to the Intellivision format with the added excitement of a mammoth Mother Ship. Atlantis, a new game on the Atari side is also available for the Intellivision, with greater detail added to the graphic elements above and below the water line. An adventure game, Swords & Serpents, was shown only for the Intellivision, as was probably the most graphically unique game playable on the Mattel: Micro Surgeon.

In this unusual game, the video screen acts as a color x-ray into a human body. You see all kinds of blood vessels and internal organs as you move the view all around a body. The view is equivalent to about one-quarter of the head, and scrolling in all directions is smooth, slow and precise. Your mission inside a microscopic vehicle is to clear the body of tumors, bloodclots, nicotine deposits and a mean tapeworm— while dodging the white blood cells who see you as a foreign matter. From preliminary play, this cartridge looks like a "must" for Intellivision owners for both graphics and unique game theme.

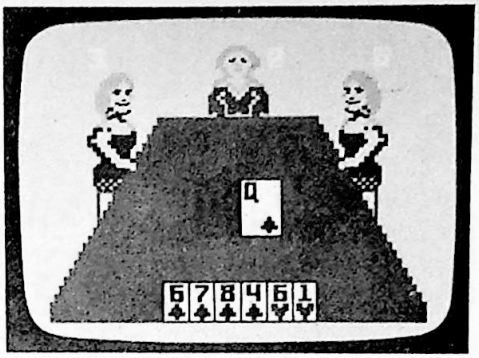
The absence of arcade-derived games for the Intellivision will be partially filled by Coleco's new Intellivision-compatible cartridges. The initial lineup includes Donkey Kong, Venture, Cosmic Avenger, Mouse Trap, Side Trak, Rip Cord, Lady Bug, Carnival, Zaxxon, and Turbo. Only Donkey Kong was working at the show. Most of the original game elements were there for at least the first board (ramps) but the color seemed to lack the punch of the original. This may be a limitation of the Intellivision system itself, so I will withhold judgement until I see Coleco's other cartridges.

You can expect to hear more from other cartridge makers about Intellivision cartridges in 1983. The momentum is tremendous.

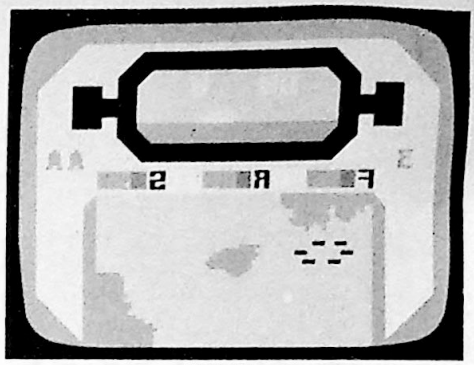
Of course, Mattel was there, too, show-



Intellivoice



Royal Dealer.



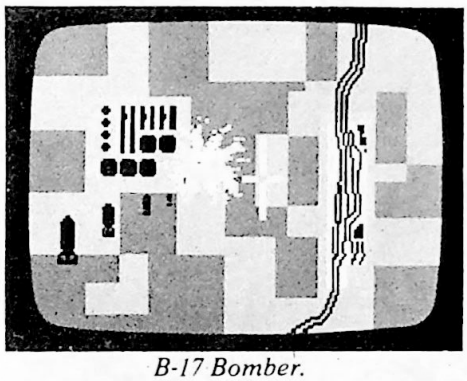
Sub Hunt.

ing more finished models of games announced in January, plus a more substantial display of Intellivoice, the plug-in speech synthesizer for the unit. Cartridge emphasis was placed on games that can be played solo, as well as by two players.

From the regular cartridge additions, the most desirable ones seem to be strategic games. Reversi and USCF Chess are obvious choices if you are partial to those traditional board games. Utopia is a simulation of building a civilization on an island while responding to the destructive forces of Mother Nature. And the card shark gets a load of new games for video in Royal Dealer: Hearts, Crazy 8's, and Rummy can be played against one, two, or three computer-controlled opponents.

On the action side, Sub Hunt puts you in command of a sub out to sink enemy ships. Your screen gives you views of both your periscope sights and a reconnaissance satellite scan of the overall situation. Two action games based on the *Tron* movie place the hero, Tron, in activities called Deadly Discs and Maze-A-Tron.

The Intellivoice add-on module is exciting—not because it is a speech synthesizer, but because the initial games designed for it have made the voice an integral part of game play.



B-17 Bomber.

Of the four cartridges announced (excuse the pun)—Space Spartans, Bomb Squad, B-17 Bomber, and Tron Solar Sailor—B-17 Bomber is my favorite. Three different screens, a realistic aerial view of assorted targets below, the sight of bombs falling away and getting ever smaller until their explosions puff on the landscape, and the voices ranging from a John Wayne imitation to a good ol' Georgia boy bombardier—these make the game most appealing. While you are bombing a target, one of your crew members alerts you to bandits coming in at a specific angle—it is time to shift screens to do battle. Fabulous.

Odyssey2 Speaks

The only video game to sport a full typewriter keyboard, Odyssey2, featured working examples of its add-on speech synthesizer called, simply enough, The Voice. The module sits on top of the Odyssey2 console—blending well into the contours of the O2—and connects to it by way of the game cartridge slot. A volume control is provided since, unlike Intellivoice (above), the speech comes through a speaker in the module, rather than through the TV.

Voice titles are: Type & Tell, S.I.D. the Spellbinder, and Nimble Numbers N.E.D. It was also announced that popular Odyssey2 cartridges such as UFO would be re-issued in the future to take advantage of the voice.

While the voice quality is good (using the General Instruments speech chip set), the voice is not well integrated into the play of the cartridges—it supplements the

The Voice.

activities, but *does* not add a dimension to the game. *In fact*, I learned from Dave Arganbright, Vice President and general manager *of* Odyssey division (it no longer is part *of* Magnavox, but its own division of NAP Consumer Electronics Corp.) that voice cartridges will be compatible with

Pick Axe Pete.

the Odyssey2 unit alone, so the voice is not likely to be the key element of a cartridge. To me, that eliminates any incentive to buy the $100 voice module.

Odyssey revives their popular (until Atari pulled the plug) K.C. Munchkin character in a new cartridge called K.C.'s Krazy Chase. Pick Axe Pete is a new character in an adventure-type journey through caverns and the like, in search of a gold key.

Perhaps the best Odyssey news is that Imagic is scheduling the first independently produced Odyssey cartridges for 1983. It will be most interesting to see how fresh program approaches will be executed on the Odyssey2.

Bally's New Name, New Games

Astrocade is now the name for the deluxe home video game that started life as the Bally Arcade. The company changed its name from Astrovision, probably to keep it from getting confused with Activision, the Atari cartridge developer. By any name, this unit has one of the best graphics and sound packages of any home video game, and some new cartridges that really show it off.

The Incredible Wizard is an incredibly good replica of Bally's Wizard of Wor arcade game. From the opening music to the between-wave screen announcements of double or quadruple scoring to an arresting light and sound show for blasting the speedy Wizard, I will take the Astrocade version over the arcade anytime.

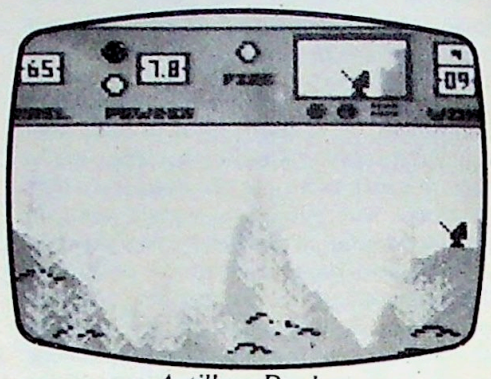
Among other new action cartridges like Solar Conqueror, Cosmic Raiders, Conan the Barbarian (adventure type game), or Pirate Chase, the cleverest graphics award goes to Artillery Duel. The cartridge is less of a game, per se, than it is a visual delight—something you would throw onto a projection TV at a party.

At the outset, a randomly selected battlefield is drawn on the screen, with a gun emplacement at each side. A small platoon of soldiers (your guys) march up to your gun. Digital indicators from a control panel display your settings for elevation and amount of powder for the next shot. Another digital display shows the wind direction and speed. Then, an amazing color reconnaissance camera is focused on the enemy gun—you see the color monitor on the panel. To add a bit more realism, the TV image flickers occasionally.

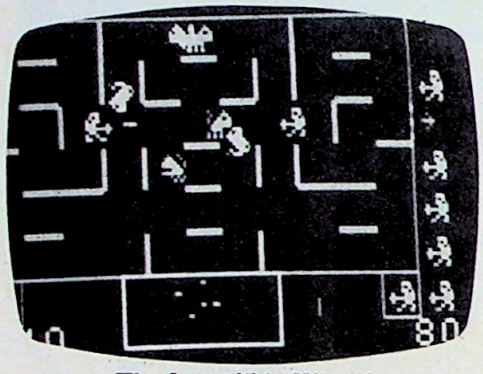
A direct hit or enough near misses cause the enemy gun to blow to smithereens, blackening its entire hillside. Your victorious platoon leaves its gun, marching away in formation. It is really a graphics showpiece with a little bit of player interaction thrown in.

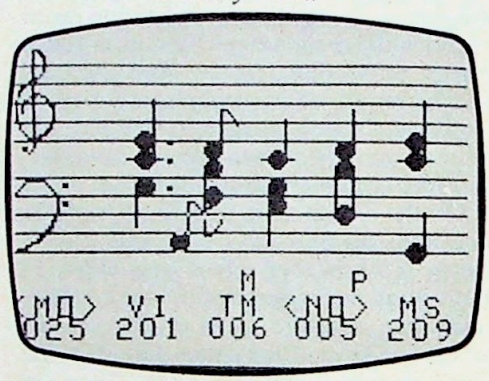
Lest you think the trajectory data is arbitrary, Astrocade advises that the game designer is a consultant to the U.S. Navy on computer programs for fire control weapons and missile systems.

Two new Astrocade cartridges may inspire the artist in you. Creative Crayon



Artillery Duel.



The Incredible Wizard.

Music Maker.

Astrocade.

is a sophisticated graphics generation program that lets you create colorful shapes on the screen with a light pen. Music Maker lets you explore the three-voice music synthesizer of the Astrocade, with music notation showing on the screen. With both cartridges, you can store data on cassette tape for playback later.

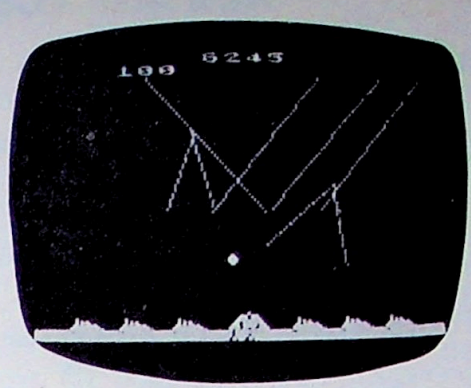
More, Astrocade! More!

Atari 5200, A Cut Above

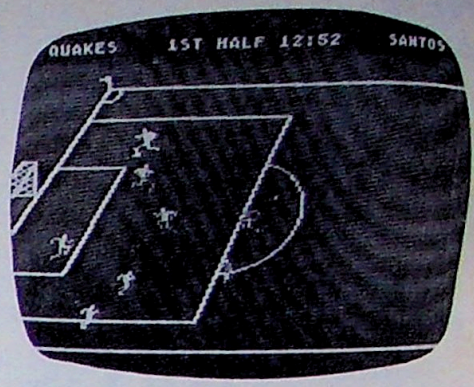
The summer show was my first chance to play with Atari's advanced video game system, the 5200—an Atari 400 without keyboard. As anticipated from an earlier hands-off preview, most of the space and arcade games were copied from the Atari 400/800 computer games, with the same high resolution graphics and sound.

I noticed one difference, however, in the Pac-Man game. After the second and fourth times clearing the maze (or boards), you get a graphic/music intermission, as on the arcade version. The other titles in these categories are Space Invaders, Star Raiders, Galaxian, Missile Command and Super Breakout. All of these are well done on the 5200, with Star Raiders the most engaging of them all.

The 5200 also makes use of its expansive program memory and graphics for some sophisticated sports games. Baseball, Football and Soccer will be ready this year. With the combination joystick-paddle-keypad controller, you can input much more information for game play than on the VCS.



Missile Command



Soccer.

Coming in late 1982 and early 1983 is an impressive lineup of software and accessories for the 5200. Planned software titles include Defender, Centipede (the home computer version on display was an impressive reproduction) and Qix. A voice synthesizer module, a TrakBall controller and a VCS cartridge adapter will lure many a veteran game player to the 5200.

Some observations on the 5200 controllers: First, the Start, Reset, and Select buttons are on the controller—Bravo! Second, the joystick has Trak-Ball characteristics, i.e., the faster you move it in any direction (360 degrees), the faster the screen cursor or character moves. This made for some awkward Missile Command playing at first, but would probably not be a problem after some practice.

The initial tendency, however, is to be rough on the joystick, as you are on a VCS joystick, for example. This rough handling took its toll on both controllers hooked up to a 5200 displayed with the popular Pac-Man cartridge in it. Both controllers were inoperative by the morning of the third day of the show, and had to be replaced. I hope Atari designers will use the show experience to discover where improvements can be made in the durability of these replaceable, but costly, components. *(Text continued, pg. 196)*

Kelly's Computing

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New Atari VCS Cartridges

Manufacturer	Game Name	Description
Atari Inc. 1265 Borregas Ave. Sunnyvale, CA 94086	Demons to Diamonds	Two-player game; blast "good" demons, avoid "bad" ones
	Earth World	Wild Adventure through 12 magical rooms
	Raiders of the Lost Ark	Overcome 13 perils while seeking the ark
	Baseball	Improved graphics
	Volleyball	One or two players
	Football	Better than the previous one
	Fail Safe	Improved, re-do of Combat tank game
	Frog Pond	Frog tongue zaps flies
	Defender	Blast aliens with lasers and smart bombs, save humanoids
	Berzerk	Dodge through maze with nasty robots
	Math Gran Prix	Two-player game teaches math
Activision Inc. 2350 Bayshore Frontage Rd. Mountain View, CA 94043	Star Master	Space battle in genre of Star Raiders
	Chopper Command	Helicopter gunship moves 4 ways. Like Defender
	Pitfall!	Avoid jungle obstacles
	Megamania	Outlandish objects rain down from above
Arcadia Corp. P.O. Box 2070 Saratoga, CA 95070	Phaser Patrol	Space battle a la Star Raiders
	Communist Mutants from Space	Meanies rain down from Galaxian-type formations
	Fireball	Breakout with unusual shaped walls
	Excalibar	Adventure-type game with a birds-eye view
	Suicide Mission	Blast bacteria in blood vessels
	Labyrinth	Multi-dimensional maze
Coleco Industries Inc. 945 Asylum Ave. Hartford, CT 06105	Donkey Kong	Mario against Kong
	Venture	Adventure-type game with a birds-eye view
	MouseTrap	Avoid the cats in the maze

Manufacturer	Game Name	Description
Coleco, cont'd	Cosmic Avenger	Combination of Galaxian and Space Invaders
	Lady Bug	Maze with rotating turnstiles
	Carnival	Shoot 3 rows of moving targets
	Turbo	High-speed auto race
	Zaxxon	3-D perspective flight of fighter
	Smurf	Fantasy with the blue furries
CommaVid, Inc. 1470 N. Farnsworth Aurora, IL 60505	Cosmic Swarm	Invade the termites' nest
	Room of Doom	You're trapped with meanies shooting through panels that open and close
	Mission Omega	Dodge obstacles and shoot interceptors
	Mines of Minos	Assemble robots and avoid aliens in a mine maze
Data Age Video Games 14583 Big Basic Way Saratoga, CA 95070	Warp Lock	Fierce space battle
	SSSnake!	Shoot the snakes—but they split in two!
	Survival Run	Grab cubes in a labyrinth
	Encounter at L-5	Yet another space battle
	Airlock	Adventure-type game in a sinking submarine
Games by Apollo 1300 East Arapaho Richardson, TX 75081	Racquetball	3-D realism, 1 or 2 player
	Lost Luggage	Catch suitcases from out-of-control baggage carousel
	Space Cavern	Battle unusual monsters from sides and overhead
	Shark Attack	Fantasy hunt for sunken treasure in underwater maze
Imagic Corporation 20665 Fourth St. Saratoga, CA 95070	Cosmic Ark	Guide space ark through foes attacking from all sides
	Atlantis	Shoot attacking aircraft with 3 cannons
	Riddle of the Sphinx	Adventure-type game in Valley of the Kings
	Fire Fighter	Fight fires and rescue victims in burning buildings
Mattel Electronics 5150 Rosecrans Ave. Hawthorne, CA 90250	Astroblast	Nasties attack from above
	Space Attack	A la Star Raiders

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Atari VCS Cartridges, continued...

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Mattel, cont'd	Super Challenge Baseball	Perspective of ballfield
	Super Challenge Football	180 possible plays
	Armor Ambush	Maneuver through enemy terrain
	Frogs and Flies	Leap off lily pad to catch flies
	International Soccer	3-D perspective of field
	Lock 'N' Chase	1 or 2 player maze game
	Dark Cavern	Robots, bats and spiders in this maze
	Tron Deadly Disks	Escape richocheting deadly discs; throw your own
	Sea Battle	Lead a flotilla of ships in battle
MCA Video Games 100 Universal City Plaza Universal City, CA 91608	No Games Announced	
Parker Brothers 50 Dunham Road Beverly, MA 01915	The Empire Strikes Back	Attack the plodding Imperial Walkers
	Frogger	Cross a highway and river
	Amidar	Close in rectangles on large grid
	Spiderman	Adventure-type game
	Reactor	Blast the control rods in a reactor core nearing meltdown
	Super Cobra	Command a helicopter gunship
	Sky Skipper	Attack giant gorillas and save a royal family
	Tutankham	Adventure in a tomb
	James Bond Agent 007	World-wide adventure
Spectravision 39 W. 37th St. New York, NY 10018	Gangster Alley	Shoot gangsters who appear in building windows
	Planet Patrol	Dodge missiles and shoot nasties in a day and night mission
	Cross Fire	For 2 players: catch nasties in your crossfire
	Tape Worm	Tough variation of blockade
	China Syndrome	Recover radioactive particles

Manufacturer	Game Name	Description
Telesys 43334 Bryant St. Fremont, CA 94539	Fast Foods	Catch flying foods; avoid the purple pickle
	Coco Nuts	Avoid the coconuts dropped by the monkey above
Tiger Electronics 909 Orchard Mundelein, IL 60060	Jawbreaker	Horizontal corridors with moving doors (On-Line)
	King Kong	Donkey Kong derivative
	River Patrol	Rescue other explorers (Sentient's Congo)
	Marauder	Shoot robots in the maze (On-Line)
	Threshold	Destroy attackers in vertically scrolling tunnel (On-Line)
20th Century-Fox Fox Video Games P.O. Box 900 Beverly Hills, CA 90213	Fast Eddie	Climb ladders, avoid nasties and capture floating prizes (Sirius)
	Deadly Duck	Shoot the silly crabs and dragonflies overhead (Sirius)
	Worm War I	Blast monster worms in vertically scrolling cityscape (Sirius)
	Beany Bopper	Use 360° laser to shoot beanies and get treasures (Sirius)
U.S. Games Corp. Vidtec 1515 Wyatt Dr. Santa Clara, CA 95054	Space Jockey	Another Defender. Activision Chopper Command or SpectraVision Planet Patrol is better.
	Sneak 'n Peek	Dumb hide and seek game
	Word Zapper	Shoot letters to make words
	Commando Raid	Shoot planes from cannon at bottom center
	Weird Bird	Catch eggs. Bad imitation of Kaboom
	Towering Inferno	Frustrating, random rescue game
	Gopher Attack	Bop gophers on the head
	Maze Chase	Yet another maze

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Coleco's Secret Booth

Uniformed ushers kept casual lookers and the competition from wandering through Coleco's display of Colecovision, a completely new video game system which promises better graphics resolution than Mattel's Intellivision at a price of about $200, and a library of popular arcade-derived cartridges to tempt us.

Those who made it inside the hallowed chambers saw, first, a wall of TV monitors showing videotapes of the 12 high resolution arcade screens to be translated into Colecovision cartridges for 1982 release: Donkey Kong, Venture, Spectar, Rip Cord, Side Track, Lady Bug, Zaxxon, Cosmic Avenger, Mouse Trap, Carnival, Space Fury and Turbo. Other planned games are sports (football, baseball, skiing), fantasy, casino games, chess, and children's activities.

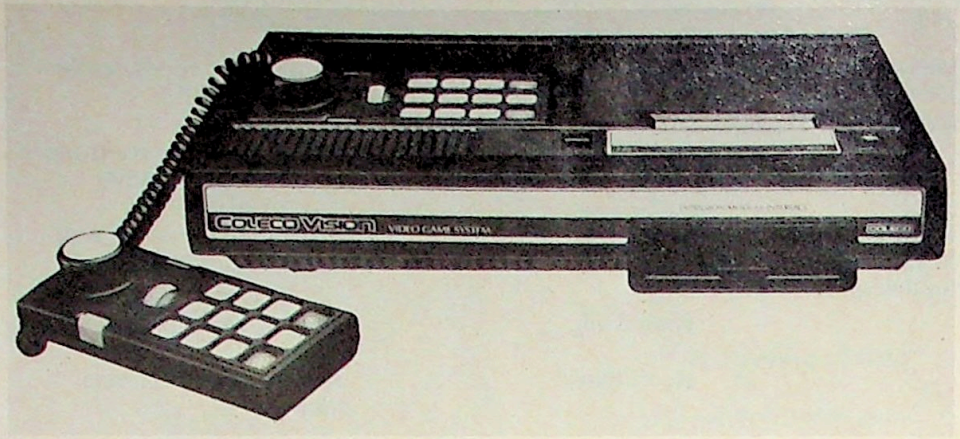
Working cartridges on display were for Donkey Kong (the cartridge packaged with the console) and Turbo. The Donkey Kong cartridge is a well executed copy of the arcade original, even with the limitations of standard color TV resolution. Turbo, however, loses some of the crispness of lines (or perhaps it doesn't have the color contrasts) I have come to expect on the high speed arcade road race.

One clever accessory that makes Turbo unique is a special driving module that plugs into the console through an expansion slot. The module features a separate steering wheel control (big enough for real two-hand driving) and a floor pedal for the gas and brake—just like the arcade version. Future driving type cartridges are planned, so you will get more use from the module than for just Turbo.

Colecovision will have another module that accepts Atari VCS-compatible cartridges. That means you will have all Colecovision cartridges, plus the nearly 150 Atari cartridges to play on one console. And they are talking about an Intellivision cartridge adapter for 1983.

This was the first time I was able to play with Colecovision's composite hand controller. The joystick is easy to grab and has a good feel to it, but I would have expected a 16-direction or 360-degree joystick, instead of its eight-direction stick, for a system trying to replicate advanced arcades and sports action. The controller also features a speed control roller, which acts like a two-directional track ball.

Colecovision is a good looking unit. The controllers nest into the console, and there seems to be enough ventilation to minimize overheating (but only a night with the unit left on will tell for sure). With Atari compatibility, high resolution arcade game library of its own, and reasonable price, Colecovison should be a winner.



Colecovision.

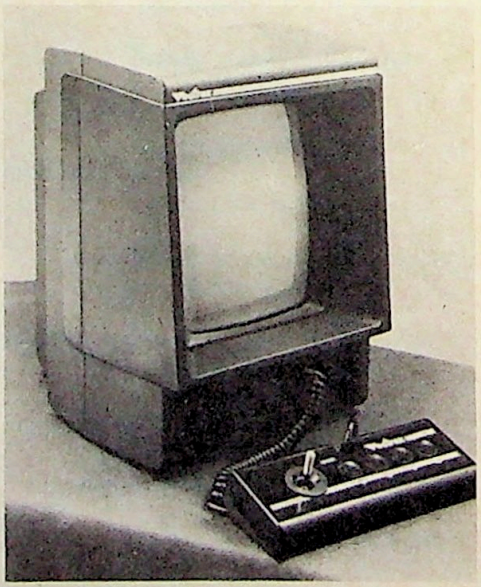
Emerson Arcadia 2001 System

If the Emerson brand name rings a bell, it is probably from a portable radio or other electronic entertainment product. This year, Emerson also means video games, with the introduction of the Arcadia 2001 video game system.

Priced in the Atari VCS range, the Emerson unit is scheduled for an initial release of 19 cartridges (incompatible with

Arcadia-2001.

Video Space Battle.



Vectrex.

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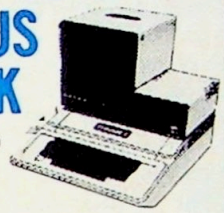

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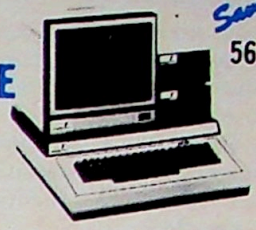

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The 72 key keyboard includes an alpha lock key which simplifies operation with existing Apple software. The numeric pad cluster includes special keys such as period, plus, minus, greater than (go to) and asterisk (multiply) that are used frequently with VisiCalc.

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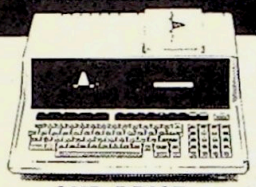

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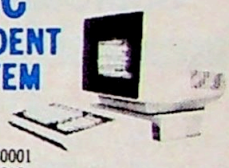

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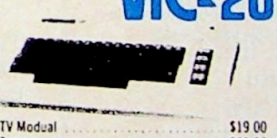

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other systems), followed by at least four more by the end of 1982. Graphic resolution of the games on display was similar to that of the VCS, and our overall impression of the game play was favorable for a system in this price range, though no cartridge stands out as being an exciting original creation.

Of particular interest to me were two unique hardware design features that the "big guns" should note. First of all, there is a red LED which shines when the power is on. How many of us have left our consoles on overnight because we turned the switchbox back to "TV" and forgot to turn off the console?

Secondly, the Emerson joystick-keypad controller is designed so you can use the direction control either as a disc (as on the Intellivision) or as a joystick. A great idea.

A Dedicated Video Game?

Just as the world became accustomed to programmable (i.e., plug-in cartridges) video games, Entex offers a low-cost alternative: a dedicated video game.

For about $65, you can buy a Video Space Battle, a space invaders type video game whose console looks like an oversized joystick controller, and hooks up to your TV set. The unoriginal game play aside, the tall joystick with top-mounted fire button, all on a wide base, makes for an appealing game controller.

Vector Scanning At Home!

I have saved the best for last. This one made me stop and caused my pulse to quicken.

I was looking at a self-contained 9" black-and-white screen, vertically oriented as in most arcade games, displaying ultra high resolution graphics (no "stairstepping" of diagonal lines), with screen characters performing smooth twists, turns, and several high speed maneuvers the likes of which I had only seen on vector scanning monitors in arcade games such as Asteroids. The unit is called Vectrex by General Consumer Electronics (GCE), and will be available on a limited geographic basis this fall.

Not intended for video game amateurs, the Vectrex games—all on plug-in cartridges except the resident game that comes with the $200 Vectrex unit—get tough fast. Screen overlays for each cartridge offer playfield details and patches of color on parts of the screen. The detachable control panel has a 360-degree joystick and four pushbuttons. Thirteen cartridges are planned for fall, including licensed games such as Scramble, Berzerk, and Solar Quest.

If you are an arcade game purist who feels home video games are beneath the game quality and skill prerequisites of the arcade games, Vectrex will give you a realistic run for your money—for only 800 quarters.

Accessories Abound

It has taken longer than I expected, but more video game accessories appeared at the show. Of course, there have been several console covers with built-in cartridge holders (though they tend to hold less than 25% of the cartridges you own), and some of the cassette tape rack makers had adaptations for video game cartridges. There was more excitement, however, in the area of accessory controllers.

A simple, yet very practical kit for the Intellivision is a product called Injoy A Stick (from Laskey Video Distributing). Following very simple instructions on the package you swap the Intellivision direction disk for a replacement disk that also

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Video Technology
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Wico Corporation
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Niles, IL 60648

has a joystick in the center. Injoy A Stick will cost under $10 per pair.

Cynex Manufacturing Corp. displayed a prototype set of wireless joystick controllers for the Atari VCS. Each joystick unit of the Game-Mate II has a telescoping whip antenna to communicate with a control box plugged into the VCS console. Rated range is 20 feet.

Working with the prototypes, I found the reaction time, a critical factor on high speed action cartridges, to be slow, but a company spokeman said that the design was not yet finalized at the show. Target price for Game-Mate II is $79.95. Anything that can eliminate a dangling cord or two without sacrificing controller response time will be welcome.

You may not know the name Wico, but if you have ever played an arcade game, there is a good chance you have had your hands on a Wico joystick controller. Now, the company is branching out into the consumer field by packaging their commercial quality game controls for home video game use. Even their standard joystick gave me the feeling of more control than any other factory supplied joystick.

The unit has two action buttons, one at the upper left corner of the base and one at the top of the joystick—select one with a slide switch on the base. Other models to come include a deluxe version with a larger base, a "red-ball" type joystick and a trackball controller. Adapters will also be available for Odyssey2 and several home computers.

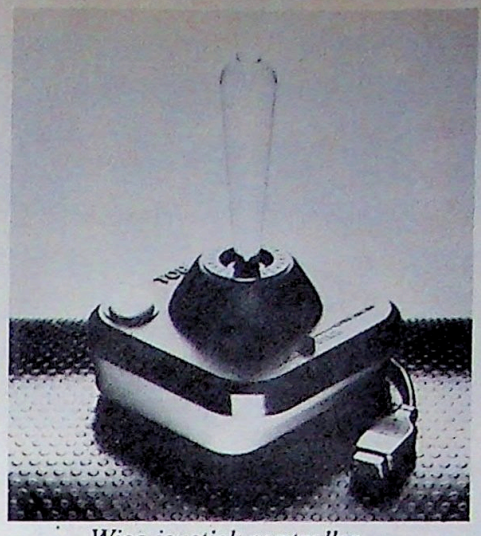
Wico has also solved the too-short-cable problem for the Atari VCS (or 400/800 computers). Six- and twelve-foot extension cords will finally let you sit back and play Atari.

Conclusion

You don't have to be a video game buff to see that the field is exploding with new companies and new products. The difficulty lies in making selective choices, either in new hardware or in software to support the machine you own. It is no longer practical—or possible for most—to own the majority of cartridges available for the VCS. And it is getting that way for Intellivision, too.

In choosing a new system, the controllers play a big role in your enjoyment of the games. The best graphics in the world won't help if you are always uncomfortable operating the controller.

Next, diversity of the cartridge library game play is important. The available games should cover a wide range of sports, space, fantasy, arcade, and the category of original games you use to introduce non-gamers to your addiction. The library should contain cartridges that really challenge the skilled player as well—and an ever increasing number of cartridges with fresh graphics, sound and game play, instead of re-hashing earlier games.



Wico joystick controller.

Selecting software for your existing system is more difficult, because individual tastes come into play, as in records or movies. But whether you are an arcade freak, a fantasy role player, a sports nut, a family cartridge devotee, or a hand-eye coordinator expert, there are plenty of cartridges to go around. Try to play the games before you buy them. Read the instructions, if they are available, to make sure the game has the challenging elements you want, or is fun for the whole family, as the case may be.

And lastly, look to future issues of *Creative Computing* for both hardware and software reviews, plus news of what is going on in this fastest paced home electronics industry. □

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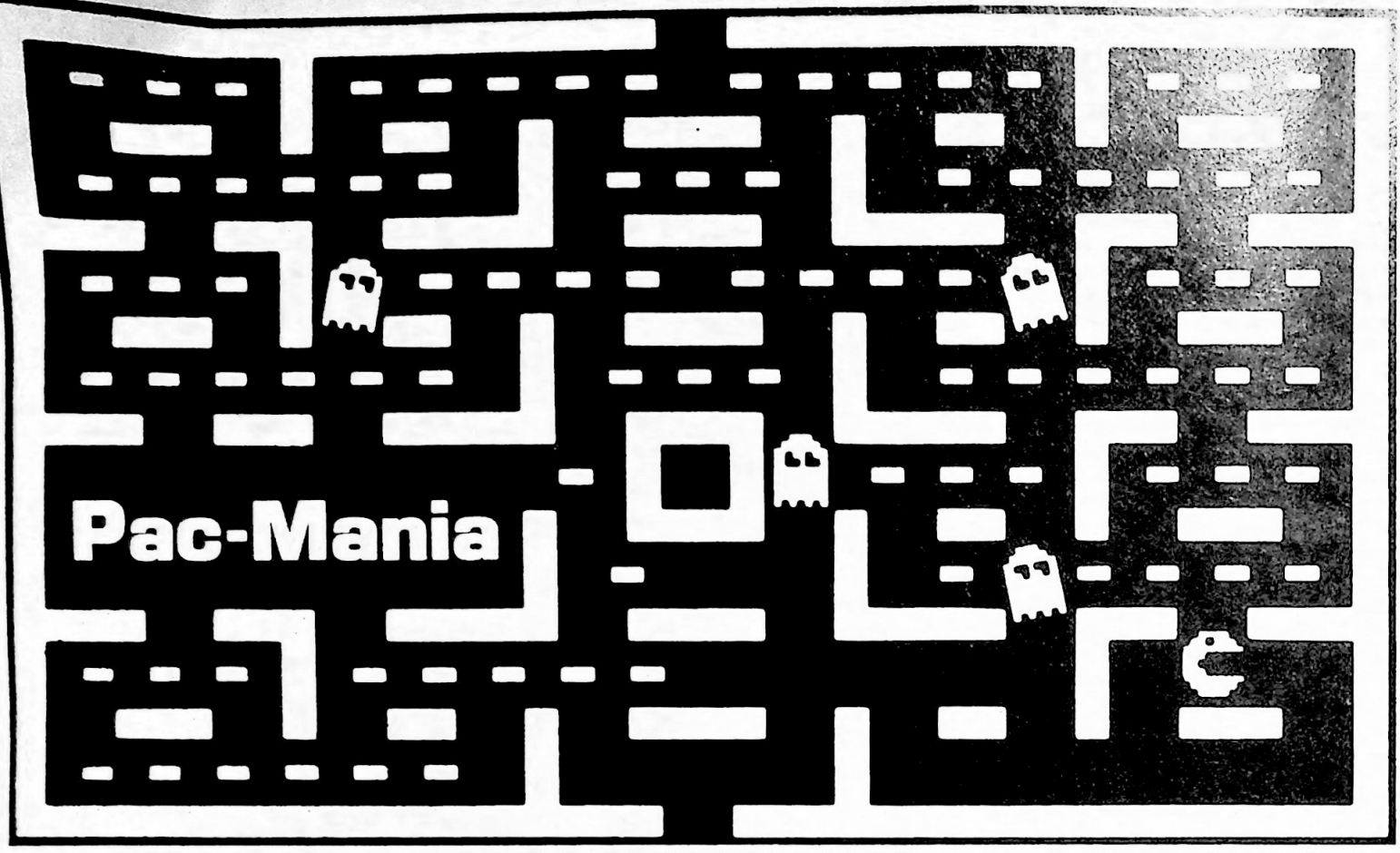

Pac-Mania

Danny Goodman

It is known as a "hot property."

In the past, it may have been a character or theme from a movie, cartoon or even a comic strip. What makes it "hot" is that people not only pay to experience the original, but long for mementos of the experience, licensed mementos that can bring lots of income to the licensee in sales, and to the licensor in royalties. T-shirts, coffee mugs, bumper stickers, bed sheets...they all bear the likeness of the starring character.

But when the star is a video game creature, in addition to the key chains, novelty telephones, and stuffed dolls, you get versions of the game itself that you can bring into your own home.

And so it is with Pac-Man, the arcade game hit of 1981, a game that was still attracting truckloads of quarters well into 1982. A few home video and electronic game makers are hoping those arcade quarters can be converted into dollars—dollars spent on home adaptations of what may be the all-time favorite arcade game.

To check out how well the action, graphics, and sound of the original could be translated to home version, I examined two handheld/tabletop Pac-Man games, plus Atari's cartridges for their VCS, 400/800 home computers, and their new 5200 video game system.

The Tabletop Challenge

Trying to reduce the complexity of detailed arcade screen graphics to a fixed, vacuum fluorescent display in a tabletop game is like trying to reproduce an automobile to a 1/32 scale model. In the model, the windows may not roll down, the dashboard has no working dials or idiot lights, and the motor won't be of the internal combustion or diesel variety. In other words, somethin's gotta give.

The Coleco screen is a fascinating study in packing many distinctly shaped elements into a minuscule plot of display real estate.

And in a tabletop game—where the intent is to draw a parallel to or imitate an arcade original—the major sacrifices are the nuances of the game that give the original its charm in the first place.

Of the two Pac-Man tabletop versions, Coleco's is far and away more arcade-like, compared to Tomy's Pac-Man. The Coleco game is one of the company's mini-arcade series replicas of four popular video games: Pac-Man, Galaxian, Donkey Kong and Frogger.

The screen is partially shaded from surrounding light by a hood—intended to remind us of the semi-enclosed feeling we get when playing full-sized arcade games. Colorful stickers, depicting the cartoon artwork on arcade cabinets, adorn the hood sides and header. Other game characters grace the edges of the screen and the control panel area.

The controls on Pac-Man consist of a simple slide switch (Skill 1, OFF, and Skill 2), plus two, four-direction joysticks. The left stick is your Pac-Man direction controller and Game Select switch. Yes, there are four choices in game selection.

The first is a self-running demonstration, not particularly useful once you own the game, but surely an eye- and ear-catcher on the store counter. For actual game play, you can choose from: 1) "standard" one player Pac-Man; 2) a rather interesting two-player ("Head-to-Head," in Coleco terminology) Pac-Man in which you and your opponent vie for the same dots and monsters—the scoreboard shows the points difference between the players and who is ahead; and 3) a novel variation called "Eat & Run" in which the screen shows only the four energizer dots, a monster guarding each, and your Pac-Man. You must snatch one of the energizers and take it back to the central pen when the door opens—of course while all four monsters are on your trail. In many ways, Eat & Run is more fun to play than Pac-Man, and having all three games in one cabinet is quite a deal.

Danny Goodman, 275-B Island View Lane, Barrington, IL 60010. Source number: ST0450.

Coleco Pac-Man.

The screen is a fascinating study in packing many distinctly shaped elements into a minuscule plot of display real estate.

By itself, the display yields three colors: red, yellow, and a bluish-green, common to VF calculators. A fourth color, a distinct purplish, is achieved at specific display areas by a color filter bonded to the screen face.

To overcome the problem of portraying so many different characters—Pac-Man, monster, dot/energizer—at a given point, the display designers developed a composite screen character which, when fully illuminated, features the outline of a monster, a Pac-Man with mouth either open or closed, and a dot.

Each element of the composite appears to be addressable such that only a dot or only a Pac-Man can show. Or light up all elements, and you have a monster. Dots and Pac-Men are yellow, while monster outlines and the four energizers are red. Lines composing the maze walls are also red. When Pac-Man eats an energizer, the Pac-Man elements of all four monsters disappear—equivalent to "blue time" on the arcade original—and flash a few times just before the monsters regain their power.

The screen layout is a grid, nine of these composite characters high and eight wide. Above the grid are two rows of status indicators, including number of Pac-Man "lives" left in the game, and "GAME OVER" sign, arrows pointing left and right (to show who is ahead in Head-to-Head play), and the word "BEST" which shines at the end of the game with the score of the highest game of one-player Pac-Man played since the machine was turned on. The five score digits are located at the top of the screen.

I like many of the features of Coleco Pac-Man. For one, the maze layout is about as close to the original as affordable VF technology can get. It is not perfect, by any means, but for the 64 dots/4 energizers on the playfield, the wall layout lets you zoom around corners in smooth patterns as on the original.

Music is another plus. Not only do you get the Pac-Man opening theme when

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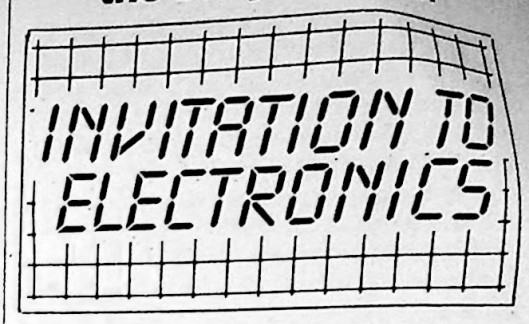

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you select a game, but you also get a short rendition of the intermission theme from the original game each time you clear a screen of all dots. And, as on Midway's quarter-eater, you get an additional Pac-Man at 10,000 points. This is no easy feat, because, where you may be used to scores in the 6-8000+ range after the first arcade screen, Coleco's scoring system will probably hold you to 2-3000 points.

Yet all is not roses for the Coleco. One major disadvantage of the VF display is that all characters must "step" from location to location. The stutter-stepping movement is difficult to predict, especially when monsters are breathing down your neck. You can't tell which way they are going to move at a corner or intersection, so you unnecessarily lose quite a few Pac-Men.

There is no fruit to go after, either. In the arcade, the chance for a bonus score is a marvelously distracting element.

Next, the noise of the game, a kind of electronic whining, doesn't make the grade in reproducing the original sound. That would be all right, but it is so loud and constant that it drives you nuts after a while. Why don't all tabletop makers take a cue from Entex and offer a mute playing mode?

Finally, what may be a minor point—minor, that is, until you get good at the game—the highest (BEST) score you earn or Skill 1 will be erased from memory when you try to compare your prowess at the Skill 2 level, because the switch passes through the OFF position to get there. There must be a better way to do that.

The price (under $75) may be a bit steep for some, especially since it is a "dedicated" (non-programmable) game. But my guess is that Coleco's Pac-Man will be on many Christmas "wish lists" this year.

Tomy Pac-Man.

Tomy Pac-Man

A much less true-to-arcade version comes in Tomy's yellow disc-shaped Pac-Man. The cleverness of the game's design, however, stops at the basic shape and color.

The vacuum fluorescent display of the unit is simple in concept, with distinct figures for Pac-Man, monsters and dots, in a horizontally oriented, five-by-eight grid. With each character depicted separately, Pac-Man and a monster never occupy the exact same spot—they can only stand side-by-side in the same grid block. You never know, then, when you are about to be caught by a nearby monster. Nor do you experience that satisfying arcade feeling of having your Pac-Man literally gobble up a monster when he is energized.

Only eighteen dots and two energizers are scattered about the extremely simple maze. Control of Pac-Man is by four directional pushbuttons—an arrangement which has always been awkward for me, whether on a handheld game, or on a microcomputer game without joysticks. The most bizarre aspect of this limited reproduction game is that Pac-Man can eat dots only when he is travelling from right to left. I suspect this was thrown in to compensate for the sparse maze.

One redeeming feature of the Tomy game is that the fruit symbol (cherries) appears in a special box twice during each screen. If the game had a more complex maze, this element would add a great deal of excitement, because the opportunity for a bonus makes you take greater risks and breaks up your pattern. But in this maze, you are practically guaranteed of picking the cherries off every time. And, again, Pac-Man doesn't "eat" the cherries. All he does is stand next to the fruit to score 100 points.

One other nice Tomy feature that would have been a blessing on the Coleco is that after the game, the scoreboard toggles between your final score and the screen level you were on. Good players might otherwise forget after a few boards.

For its lack of imitation of the original, however, Tomy's unit has a place in the market with a price of under $35. The sound package may not be as annoying to adults as the Coleco, and the unit may satisfy the youngster demanding some kind of home Pac-Man action.

Video Renditions

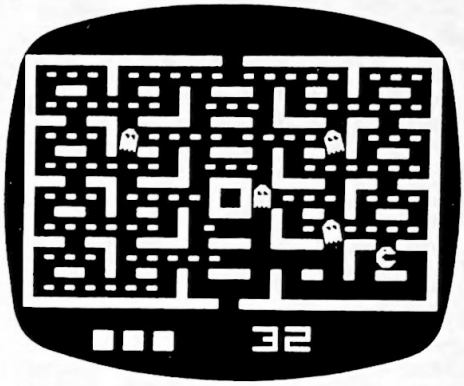
Atari raised the expectations of VCS owners when they announced the coming of the only officially licensed Pac-Man video game cartridge. In fact, as one method to keep potential VCS buyers from straying to Brands X, Y or Z at Christmas last year, Atari ran newspaper ads foretelling of the impending arrival of Pac-Man in VCS cartridge form.

In their early 1982 cartridge catalog, Atari stated clearly in its description of the cartridge that Atari's Pac-Man "differs slightly from the original." That, perhaps, was an understatement.

The maze layout is horizontally oriented—a necessity for home TV sets—and has escape hatches at the top and bottom of the screen. It takes only a couple seconds of working Pac-Man through the maze to realize that the maze itself is no piece of cake. There are few long straightaways, and it is not easy to find patterns that allow smooth flow for Pac-Man without having to double back over covered territory to get one last dot in a quadrant.

Other graphic elements roam far from the original. Dots are played by dashes, bonus fruit is played by a yellow and orange box called a vitamin, and the four energizer dots are portrayed by dashes called power pills.

Pac-Man has a different way of opening his mouth in Atari's version—sort of a vertical chew, rather than the customary hinged gobble. Monsters, called ghosts, don't have moving eyes to indicate their direction, and they are all the same color. They do, however, turn a bluish color when Pac-Man is energized (power pilled?). The game starts with four Pac-Man lives, and you earn an extra Pac-Man each time you clear the board of dots.



Atari VCS Pac-Man.

As with most Atari VCS cartridges, this one, too, offers several game variations—eight to be exact. Each variation controls the speed of Pac-Man or ghosts. Game number six is the fastest speed, and probably the one skilled players should go to immediately.

One word of warning: you must anticipate turns early. Pac-Man is a bit slow to react to the joystick—but he is on the arcade version, too.

Interest in the Pac-Man cartridge exploded when it first became available in March, 1982. But by early summer, there seemed to be either plenty of cartridges around in the stores, or a diminished interest in the VCS version. I suspect the latter, as word-of-mouth spread that the game was nothing at all like the arcade game.

Much criticism has been hurled at the Atari game designers about Pac-Man. In a way this criticism is unfair. Granted, as a replica of the original arcade board, the VCS cartridge fails miserably. But as a challenging video maze game on its own merit, it would rank high on the list of great cartridges if the arcade game had never existed.

Atari's Pac-Man is not a bad cartridge—just a sad replica of an arcade game. Limited graphics ability of the VCS is partly responsible, but the real problem is that the cartridge is called Pac-Man with an asterisk: referring to the Midway trademark. Atari seemed to gobble up the video game rights to a very popular game—leading VCS followers to assume

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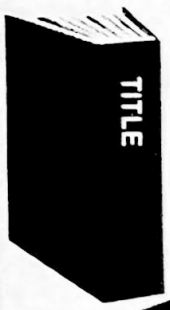

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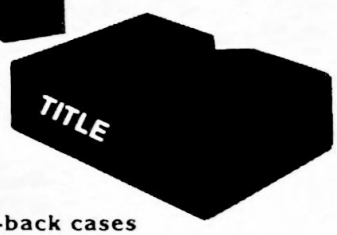

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Atari would try to imitate the original elements—and therefore keep would-be competitors out of the dot/maze game cartridge arena (Odyssey2 and Astrocade had dot/maze games on the market and in the wings, respectively). Thus the great Pac-Man VCS expectations were shattered.

Computer Pac

Even if the VCS cartridge pulled the rug out from arcade aficionados, Atari's home computer and 5200 advanced video game system cartridges will make them drool. Whereas the VCS game play scarcely resembles its founding father, the more expensive home versions have practically everything covered, and covered well. About the only visible difference between arcade and these home Pac-Man games is the orientation of the video screen. The home TV is irrevocably a horizontally proportioned device, while most arcade screens are vertically oriented.

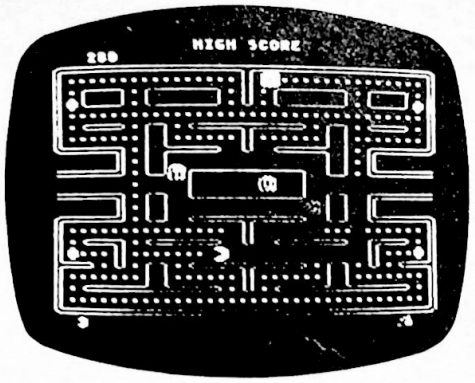
But everything is faithfully reproduced: the different colors and behaviors of the monsters, skill level symbols at the lower right of the screen (also appearing twice each board for bonus points), scoreboard "1 UP," "2 UP," and "HIGHEST SCORE" at the top. Scoring is identical to the original, including an extra Pac-Man (as shown on the lower left of the screen) at 10,000 points. For trivia fans, these advanced Atari version screens have 256 dots vs. 240 on the arcade.

The 5200 system cartridge won me over with the finishing touch: two intermissions.

Sound cues are a bit different. I guess the sound chip inside the computer and the 5200, its close relative, can't recreate my favorite "wocka-wocka-wocka" sound.

Instructions are simple, and they include something most Pac-Man fanatics had to learn from a Pac-Man beater's paperback guidebook: a chart of Pac-Man, Blinky and other monster relative speeds at each board level, plus the length of monster blue time and number of transitional flashes before turning aggressive at each level.

As much as I liked the computer cartridge, the 5200 system cartridge won me over with the finishing touch: two intermissions, complete with arcade game music and humorous scenes. I haven't seen the second intermission yet, but I presume it is like the arcade game, and we are spared the third intermission which shows what a disrobed monster looks like.



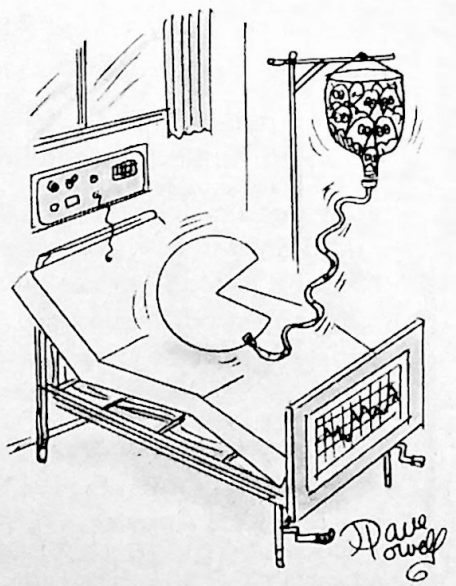
Atari 5200 and 400/800 Pac-Man.

Both versions offer a feature Pac-Man freaks would certainly like to see on the arcade machine. At the press of a button, you can select the starting point of the game from eight different levels, ranging from Cherries (1st maze) to Keys (13th maze). That way, you can practice higher levels without wading through the slow, easy levels.

What is so amazing about the computer and 5200 versions is that the displays have remarkable graphic detail in a far coarser resolution medium (home color TV) than the arcade screen: Yep, Atari did pull off a superb rendition—actually, two of them—of our lovable Pac-Man and his ordeal. These cartridges certainly earn the right to the asterisked Pac-Man title.

Short of trying to buy up a well-used, reconditioned Pac-Man arcade game for perhaps $1500, you can still get at least two darn good home versions for under $400 and be able to play a bunch of other arcade games besides.

Save up those quarters! ☐



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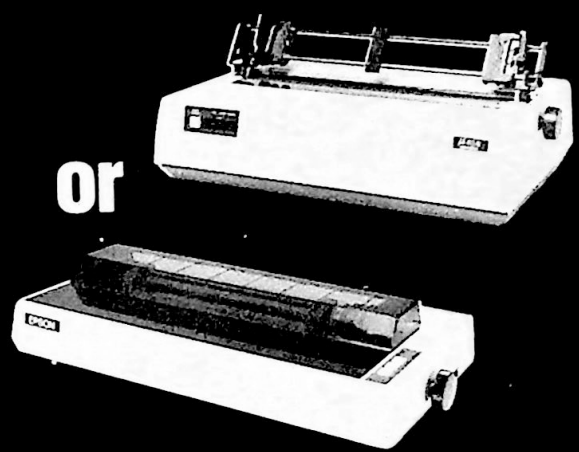

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Farewell To Arms?

Tim Onosko

Written in 1921, Karel and Josef Capek's Czech play "R.U.R." ("Rossum's Universal Robots") first presented the fantasy of automated workers and inaugrated the word "robot" into modern language. Society's fascination with robots has continued ever since.

During the Great Depression, the pages of *Popular Science* magazines were filled with visions of steely domestics, entertainers and even mechanized sports, like robot boxing. (One such magazine article under heavyweight prizefighter Jack Dempsey's byline seriously considered the question of whether the champ could ever defeat such a foe!)

In the 1950s, the "Captain Video" television program gave us Tobor (robot spelled backwards) and the MGM film, "Forbidden Planet" introduced Robby, an intelligent and magnificently complex collection of spinning gears and cogs. Two decades later, "Star Wars" would revive the robot in the form of its two comic relief players, R2-D2 and C3-PO.

All of these, of course, were mechanical personifications, imitations of the human form. Today, robotics—the science of automated manipulation—has developed far more useful, though much more prosaic robots for science and industry. Most commonly, the robot of the 1980s is a robotic arm that, when linked to computers and sensors, can perform rudimentary tasks with nearly unerring accuracy.

The leaders in robotic technology are the Japanese, who have increased the productivity of their industries by employing robots on assembly lines. It is only natural, then, that the first true robotic *toy* should also come from Japan.

Armatron is a plastic arm fifteen inches in length when fully extended. Like its real-life industrial counterparts, the arm can be manipulated via several movable sections: a "shoulder," an "elbow," a "wrist," and a "hand."

Excluding the hand, which opens and closes for grasping small objects, Armatron possesses five "degrees of freedom" (robotic lingo for the number of ways it can move). It can rotate 360 degrees and tilt up and down at its shoulder; move its forearm left and right at the elbow joint; and rotate its wrist and move it up and down.

The toy, like most toys, really has no practical purpose. Tomy, the manufacturer, provides a few small plastic objects and instructions for playing a game, however. Operating Armatron via a pair of joysticks is a little like working with one of those old-fashioned "claw" machines at a carnival or arcade.

There will probably be some debate over the educational value of Armatron, but perceptive kids (and adults) should better understand at least a few principles of robotics by playing with the arm. Too, one lesson that is learned very quickly is the complexity of moving a multi-jointed extension; we take our own human anatomy for granted.

Make no mistake, though. This is a new-age toy. Everything about Armatron is high-tech, from its slow, methodical motion (it can be controlled in two speeds) to its external design. The real beauty of this toy is the choreography of its movement. It may even be more fun to watch than to play with.

Tomy's toy designers are obviously very, very talented. Inside the base and arm of Armatron is an exceedingly complex and ingenious arrangement of dozens of plastic and metal gears, clutches and drive shafts. In fact, this mechanical movement is so clever (all of the functions of the arm are driven by one small motor) that Tomy should have encased it in clear plastic so that it could be seen in operation. A similarly entertaining toy, introduced last year, was Tomy's Air Jammer, a toy car with clear body and a functional engine powered by compressed air.

Armatron operates on two D cell batteries and costs approximately $50 at toy stores.

One word of caution: Armatron will automatically prompt some people to think of interfacing it to a small computer in imitation of real industrial robots or hobbyist arms like the Rhino XR-1. Since the toy is purely mechanical, however, this can't be achieved without a great deal of difficulty, if at all. Furthermore, the curious should approach the disassembly of Armatron slowly. This is a complicated little toy with lots and lots of tiny parts inside. Having gotten it apart, you may find yourself wondering how to get it back together.

Nonetheless, Armatron is a fascinating toy and an obvious harbinger of the sophisticated toys of the future.

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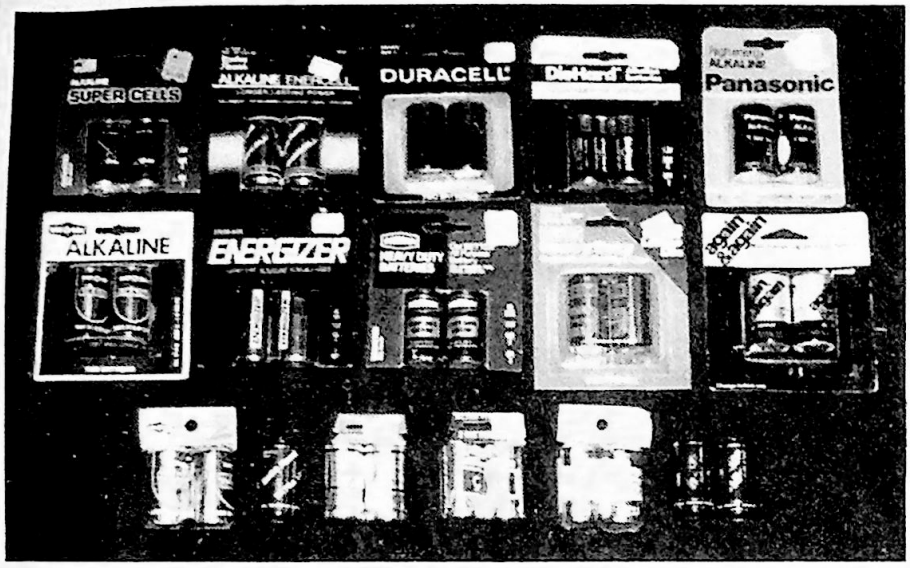

Batteries For Electronic Games

David H. Ahl

"In six months, I spend more on batteries than the game cost in the first place."

"No matter how much I yell and scream, he always forgets to turn it off, and, poof, another set of batteries shot."

"Alkaline, long life, general purpose—they're all the same—they all wear out too soon."

Sound familiar? It's difficult to get along without batteries in this portable electronic age. As a result batteries have become a big business with big ad budgets, lots of hype and not many solid facts.

One maker claims their alkaline battery lasts up to ten times as long as an ordinary battery. Another maker touts the long shelf life of their batteries. Everyone "knows" that alkaline batteries are better and sales figures reflect this bias.

What's the truth? We set out to find out. First we went on a battery shopping spree. Our informal survey of electronic games on the market this holiday season indicated that C-cells were most often required followed by AA, 9-volt and D-cells in that order. Hence, we decided to test C-cells and assume that differences between brands, if any, would hold true for AA, 9-volt and D-cells as well. Furthermore, alkaline cells are the most popular among consumers so we bought seven different brands of alkaline C-cells aong with four "long life" and four standard batteries. We also bought a battery charger and accompanying NiCad cells. In addition, we bought three battery eliminators—two with specific voltages and one "universal" type. And, just to be complete, we bought an inexpensive battery tester.

Test Procedure

The American National Standards Institute (ANSI) has a standard rating system for batteries and the battery industry also has two "standard" tests: "Heavy Intermittent Flashlight Test" and "Light Intermittent Flashlight Test." In our opinion, none of these comes close to approximating the usage one might expect in a typical electronic game. Even in games, the usage will vary widely. In a chess or backgammon game, for example, the batteries are likely to be in operation for relatively long periods (hours, perhaps, in a chess game). In a handheld action game, usage is more likely to be in short 15-minute or half hour bursts.

The life of a battery is quite different if it is in continuous use versus intermittent use because the latter gives it an opportunity to recover between uses. Alkaline batteries tend to have less voltage drop in use than others. Standard carbon/zinc cells have large voltage drops after an hour of use, but also rebound substantially overnight.

Our use test was designed to approximate use of the "average" toy or game. We measured the current drain of six representative games. The range was from 35 ma (milliamperes) to 220 ma with generally an additional 20-30 ma when the device played some sort of tune at the beginning or end of a game. Hence, we used a precision 15-ohm resistor as a load which, across 1.5v, provides a current drain of 100 ma.

While every user is different, we tried to approximate a typical use cycle. Day one, say Christmas, we had one hour continuous use. Day two, one-half hour. Day three (friends came over), two one-half hour uses with 1-1/2 hour recovery between each. Day five through battery rundown, alternate between one and two one-half hour uses per day. The discharge curves for the four battery types are shown in Figure 1. This shows the average voltage in each half hour period of use. Figure 2 is a "close up" of a portion of the curves in Figure 1 which shows the decay and recovery characteristics of the four battery types.

Test Results

We did not run every battery all the way down. Our first one-hour test (Table 1) indicated that batteries within types were roughly similar. Certainly there are differences—the Ray-O-Vac alkaline C-cell had a new load voltage of 1.50v; it dropped to 1.42v after one hour of use and recovered to 1.44v after another hour. In contrast, the corresponding readings for a Duracell were 1.48, 1.38 and 1.41.

However, we elected to run one representative sample from each battery type all the way down. We chose the Panasonic alkaline, Ray-O-Vac heavy duty, Sears general purpose and Gould rechargeable. Figure 1 shows the results of this test. The graph shows the average voltage under load (it does not show recovery time). Figure 2 shows a "closeup" of the first eight hours of use including voltage drop and recovery peaks. Note the much larger voltage variations (use and recovery) in a general purpose battery versus an alkaline cell.

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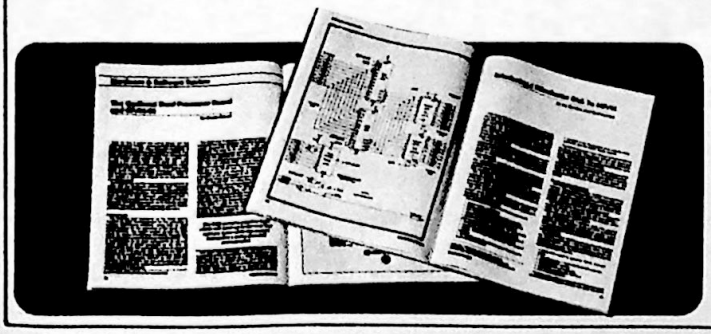

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Most games give a low battery signal or fail to function correctly when the voltage decreases to about 70-75% of the design voltage. Accordingly, we considered a battery to be dead when its voltage under load dropped to 1.1v. We then calculated the cumulative use time per dollar (average) for each of the four types.

It is apparent from Table 1 that prices vary widely. Two Panasonic C-cells for $1.25 (on sale) are an excellent buy while the regular price of Sears general purpose cells (two for $0.54) has to be considered a bargain. Consequently, although alkaline cells certainly have the longest life, we have derived Table 3 which indicates comparable prices of different types of batteries. One can see from this table that a pair of $2.49 alkaline C-cells is equivalent to $1.34 for heavy duty cells or $1.10 for general purpose ones. Hence, two Sears general purpose cells for $0.54 are equivalent to $1.25 for a pair of alkaline cells.

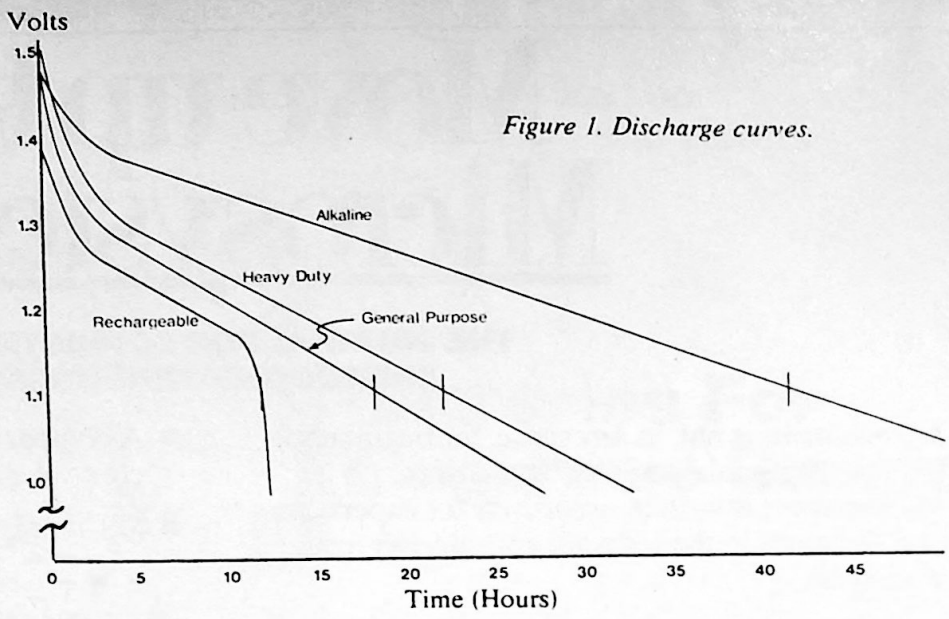


Figure 1. Discharge curves.

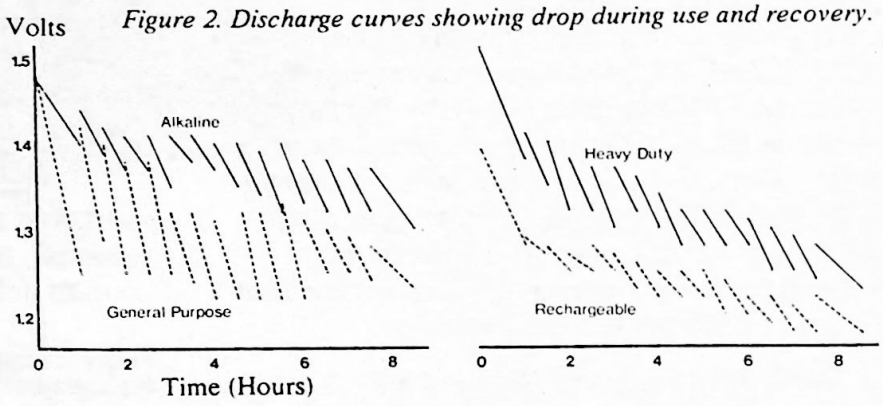


Figure 2. Discharge curves showing drop during use and recovery.

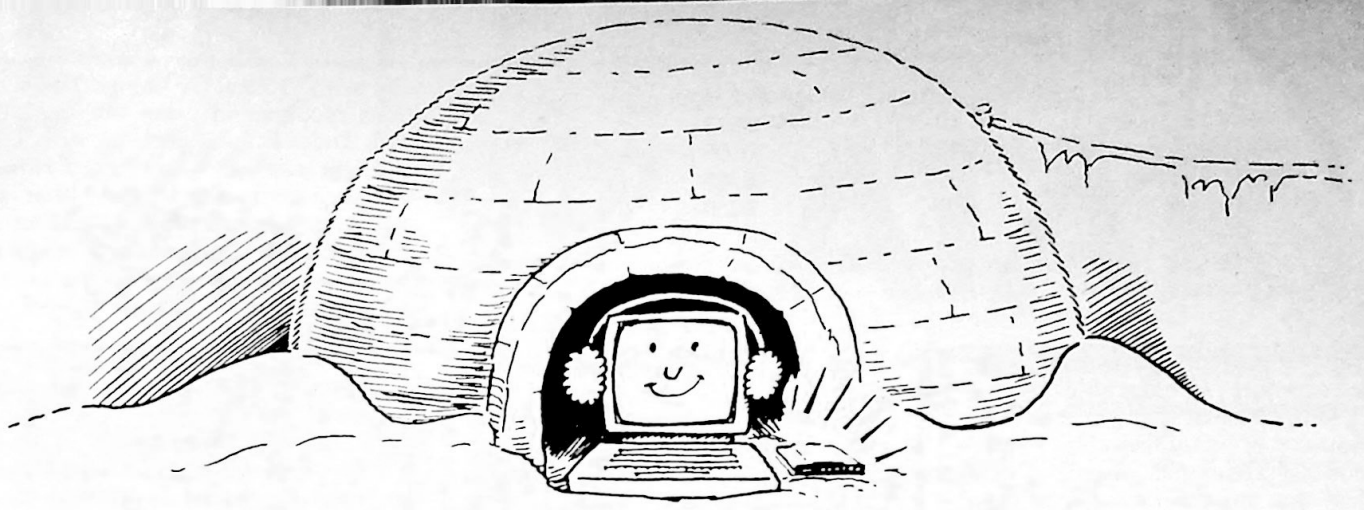
What About Rechargables?

A word about rechargeables: assuming 1000 recharges as advertised by the manufacturers, they are clearly much better buy than any conventional cells, even including the cost of the charger. We did not check the validity of the claims of 1000 recharges, as that would have taken

Brand	*Designation*	*Retail Price for Two Cells*	*New- No Load*	*New- 100 ma Load*	*After 1 hour Load*	*% of Original*	*After 1 hour Recovery*	*% of Original*
C-Cell Alkaline								
K-Mart	Super Cell	$1.88	1.55 v.	1.50 v.	1.42 v.	95%	1.45 v.	97%
Ray-O-Vac	814-2	1.99	1.55	1.50	1.42	95	1.45	97
Sears	Die Hard 4683	2.39	1.55	1.50	1.42	95	1.44	96
Radio Shack	Alkaline 23-551	2.19	1.58	1.52	1.42	93	1.46	96
Panasonic	AM2	1.25 (1)	1.51	1.48	1.40	95	1.43	97
Eveready	Energizer E93	2.49	1.53	1.50	1.40	93	1.42	95
Duracell	MN1400	2.49	1.52	1.48	1.38	93	1.41	95
C-Cell Heavy Duty								
Radio Shack	Extra Life	1.10	1.60	1.57	1.43	91	1.49	95
Mallory	M14HD	.99	1.61	1.52	1.39	91	1.43	94
Ray-O-Vac	Heavy Duty 4C	.89	1.59	1.51	1.38	91	1.42	94
Eveready	1235	1.49	1.60	1.52	1.37	90	1.41	93
C-Cell General Purpose								
Eveready	935	.79	1.58	1.49	1.28	86	1.37	92
Sears	4671 (A BEST BUY)	.54	1.59	1.49	1.25	84	1.38	93
Radio Shack	23-467	.68	1.55	1.46	1.28	87	1.34	92
Treasury	Long Life	.77	1.57	1.45	1.22	84	1.34	92
C-Cell Rechargeable								
Gould	Again & Again (A BEST BUY)	(2)	1.40	1.39	1.28	92	1.28	92

(1) Sale Price
(2) Cost for battery charger and four C-cells. $19.95.

Table 1. Battery voltage measurements before and after one hour of use. Batteries are listed in order of overall use and recovery characteristics, although differences within groups are slight. See article text for discussion and buying recommendations.



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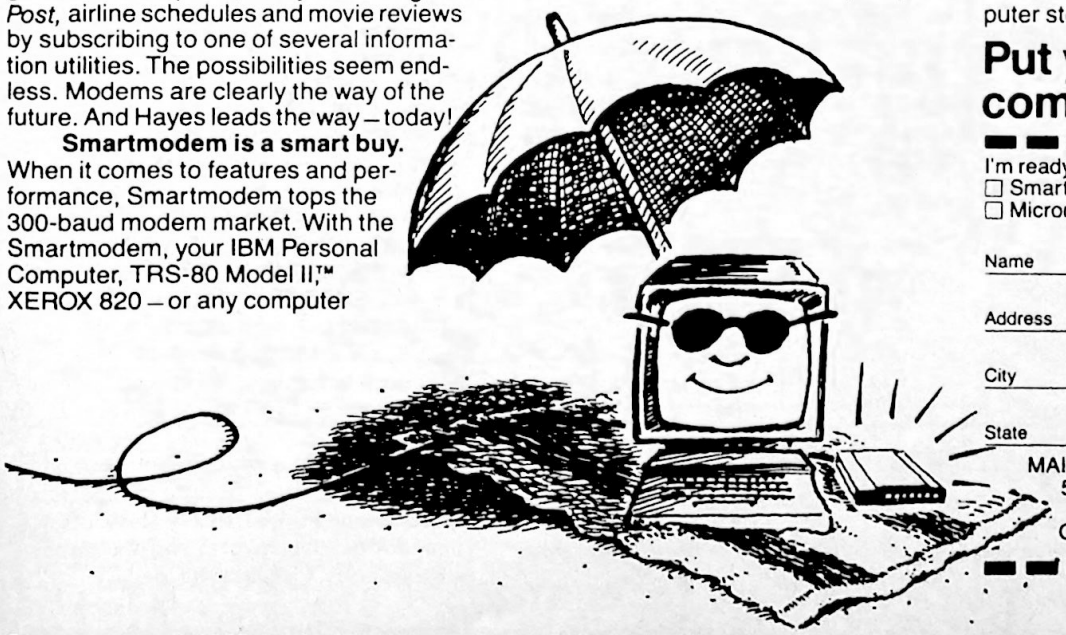

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	Average Price	Cost Per Hour
Alkaline	$2.10	$0.0512
Heavy Duty	1.12	.0509
General Purpose	0.70	.0389
Rechargeable	0.30	.0250

Table 2. Cost per hour of use of two C-cells in an electronic game drawing 100 ma.

nearly three years. However, our experience with rechargeable electric razors indicates that there is noticeable deterioration in performance after about 18 months (about 500 charges). This suggests that the theoretical maximum number of recharges may indeed be 1000, but that 500 may be a more realistic working boundary.

The cost of a charger is about $8-12 while two cells cost $6-9. This means the cost per use plus electricity for operating the charger based on 500 charges is less than 6 cents. Even with only 100 recharges, the cost is under 30 cents per use.

Counterbalancing this cost advantage is the much shorter use cycle. What this means in reality is that one must *remember* to put the batteries back on charge and that it is probably worthwhile to have two sets of batteries to exchange with each other.

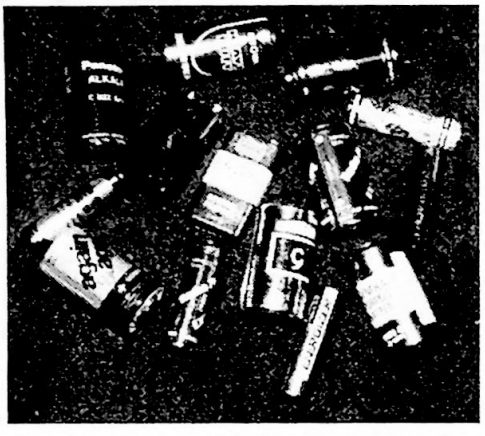
Another problem is that for best life, the batteries should not be run down all the way before recharging, nor should they be recharged too soon. Each time into the charger for the required 14-16 hours counts as a recharge cycle. So if one recharges after only 15 or 30 minutes of use, that's still one recharge cycle used up. On the other hand, if one can expect ovr 500 recharges, then $12 to $18 for two new sets of batteries every two or three years is not at all unreasonable.

Battery Eliminators?

At $5 or $6 for the typical battery eliminator, its cost can frequently be justified on the very first set of batteries for an electronic game—rarely would it take more than three sets. Some Selchow & Righter games include discount coupons for an eliminator making it an irresistible deal. On the other hand, the obvious disadvantage of an eliminator is that the device is no longer portable. Eliminators just don't work on school buses or at the beach.

We were curious about the purity of the DC voltage from eliminators. Displaying the output on an oscilloscope revealed nasty sawtooth waves from all three eliminators. Fortunately the games we tested weren't at all fussy about well-filtered DC. However, we would strongly advise against using a cheap eliminator with any microproccessor-based circuit such as an Atari video computer system. Although it looks like an eliminator, the Atari power supply has a whopping condenser inside that smooths the output voltage considerably.

One problem we experienced with a so-called universal eliminator is that the four-way plug/outlet had no shanks on the plugs and thus would not work with games that had recessed jacks. More annoying was the fact that about half of the games we tested had no provision for an eliminator.



Battery Testers

Most inexpensive battery testers ($4-$10) are nothing more than voltmeters with, generally, five to seven different ranges to accomodate batteries of different voltage. The scale is typicaly marked with just two zones: replace (red) and good (green). On the 1.5v range on the Radio shack tester we bought, the division between the two ranges fell at 1.1v.

Since we found that most devices started to malfunction when voltage fell to 1.1, a tester is an accurate indicator of whether or not a battery will work, right?

Well, maybe. The Radio Shack tester, like most others, has three built-in loads for each voltage range. For 1.5v cells, the loads were 10 ma (150 ohms), 50 ma (30 ohms) and 150ma (10 ohms). The instructions recommend using the heavy load with D-cells, medium load with C-cells and light load with AA batteries. However, our measurements showed that some electronic games using AA batteries draw up to 200 ma. Thus a battery might read "good" on the low range (10 ma load) but would not operate in a game with a 200 ma current drain.

In general, we recommend using the medium and high load of a tester for all batteries. There are few devices, even including calculators, that draw as little as 10 ma. Even so, a tester will give only a general indication of condition.

The real test is whether or not the battery will power a particular game, radio or flashlight. And the only way to determine that is to try it in the device.

Alkaline	Heavy Duty	General Purpose
$2.75	$1.47	$1.21
2.50	1.34	1.10
2.25	1.21	.99
2.00	1.07	.88
1.75	.94	.77
1.50	.80	.66
1.25	.67	.55
1.00	.54	.44

Table 3. Equivalent prices of three types of batteries.

Conclusions

In tests approximating the use of batteries in electronic games alkaline batteries lasted for 41 hours, heavy duty batteries for 22 hours and standard carbon/zinc cells for 18 hours. Our tests in no way substantiated manufacturer claims for heavy duty batteries (more than twice the life) or alkaline batteries (up to seven times the life) compared to general purpose cells.

Assuming the prices we paid were representative, the cost to operate an electronic game requiring two C-cells would be about five cents per hour using either alkaline or heavy duty cells, just under four cents per hour using standard cells and two and one-half cents with rechargeable batteries.

One of the "laws" of electronic game use is that the game will be left on overnight at least once a month. No matter what kind of cells are being used this will run them down. Hence, because of this as well as the comparative cost we recommend rechargeable batteries as the best buy. Our second choice would be to use a battery eliminator when the game is used at home and general purpose cells for other use. We recommend shopping for the cheapest general purpose cells and buying four or five sets. Manufacturer claims to the contrary, we can find little reason to pay premium prices for either heavy duty or alkaline batteries.

For use in cassette recorders or devices sure to be shut off after every use, alkaline batteries may represent a convenient (fewer battery changes) and economical alternative. But use Table 3 as a price guide. If a pair of standard cells cots $0.79, a pair of alkaline cells would have to cost $1.75 or less to be a better buy. Table 3, incidentally, is applicable to any kind of battery: D, C, AA or 9-volt.

Finally, a word of warning. We purchased one set of Treasury "Long Life" batteries which seemed to be heavy duty cells. It turned out they were simply general purpose cells. *Caveat emptor.* □

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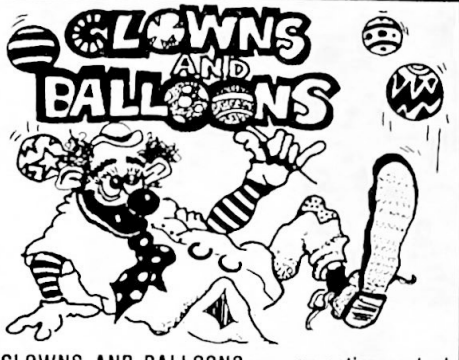

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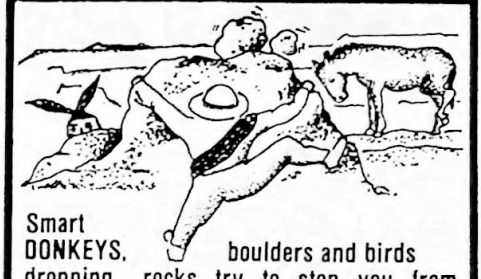

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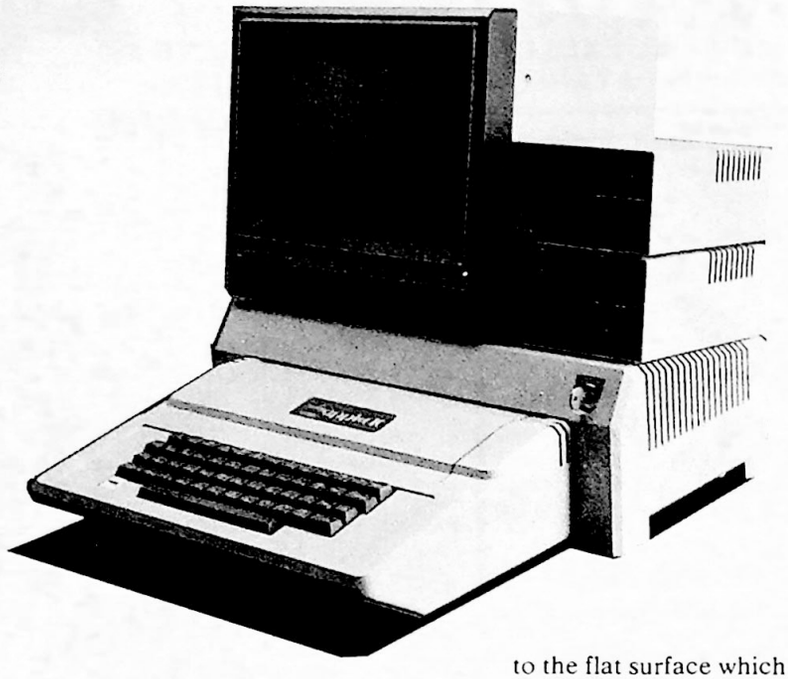
Put One Over On Your Apple

David H. Ahl



The Apple II has been on the market for several years and looks likely to remain a strong seller for several years to come. Given this stability, Apple and several other hardware manufacturers are marketing a broad array of plug-in boards for the computer. Today, it is rare for anyone who has had an Apple for more than six months not to have at least one plug-in board added on to it. More active users have three or four boards and some people have the entire computer populated with boards while others sit on the sidelines waiting their turn at being plugged in.

I was suffering from the "too many boards" problem and my Apple was suffering from overheating. Not often, but just enough to be mildly annoying. Hence, I was thinking about a fan. I liked the looks of the Super Fan II from R.H. Electronics which clamps on the left side of the Apple and matches the Apple case in appearance although the one from the Sup-R people that fits inside on the right rear also had appeal.

At the same time, I was thinking, "Gee, maybe I ought to get one of the housings that holds the disk drives and monitor since I am always changing boards around and forever moving the disk drives off the top and plugging and unplugging things."

So it was with more than passing interest that I looked over the Station II from Trace Systems when I was at the Silicon Gulch Games Faire last November. Here is an attractive unit that fits over the back of the Apple on which both the monitor and one or two disk drives can perch. It has an optional fan built in the left side of the unit, and it seemed to have several other nice features.

Station II is a molded, high impact plastic case identical in color and style to the Apple II. It fits over the rear of the Apple and projects out to each side by about two inches. Hence, it has more than enough room on top for a nine or twelve inch monitor and one or two disk drives (stacked).

Station II is equipped with three power outlets, so that cords and cables that normally clutter the area between the Apple and monitor and a power outlet are tucked neatly inside the back of the unit.

The photographs in the Station II instruction manual which show how this is done are wonderful in their clarity and neatness. Unfortunately the reality of folding up real power cords is not nearly so neat, tidy and easily done.

Also, although Station II boasts of three power outlets, one of them is used by the optional fan so that the Apple and monitor are the only thing that may be plugged in. Unfortunately, I was hoping to control the amplifier I use for the ALF music synthesis boards from the Station II, but this was not possible.

Although security was not a factor in my installation, Station II is designed to provide security in environments where it is needed. Station II may be bolted with four bolts to a desk, the Apple computer put inside and a keylock turned so that a clamp grips one of the ventilation slots of the Apple and prevents it from being moved. This same keylock turns on the power to the system. My only minor objection to this arrangement is that the Apple must frequently be jiggled back and forth in order for the clamp lock to be either opened or closed. However, in an environment where security is a factor, this objection is minor indeed.

A very nice feature of Station II is the line voltage surge suppressor which could potentially prevent the loss of a program due to a power surge. Station II also lets the user move the Apple in or out and choose the distance from keyboard to monitor that's right for him or her. I also found it convenient that Station II positions the monitor at about a twelve degree angle to the flat surface which is about right for an adult although not so good for a small child (a cushion will solve that problem, however).

The Station II literature boasts that "Your Apple is free to slide in and out which allows the user to get inside his Apple without unstacking and restacking peripherals." Strictly speaking, this is true. However, those cords that I went to so much trouble to arrange reasonably neatly when I placed the Station II over my Apple became a jumble of wire worms after pulling the Apple in and out a few times to exchange peripherals.

I could have lived with this, however the bigger problem was that several peripherals such as the ALF music boards and Aurora Videodisc interface have several cables which had to be snaked through the back of the Apple and through the underside of Station II to be hooked up to other devices. Clearly Station II was not designed to have boards such as these interchanged with any regularity. Indeed, if it were bolted down it would be almost impossible to change this kind of board and cable arrangement.

I don't wish to leave a negative impression. I like Station II. I find the absence of cords all over my work area a definite positive feature and the built-in fan has completely eliminated any overheating problems that I had previously.

Station II is available through computer retailers for approximately $129; the fan costs an additional $49. For more information, contact Trace Systems, 1928 Old Middlefield Way, Mountain View CA 94043. (415) 964-3115. □

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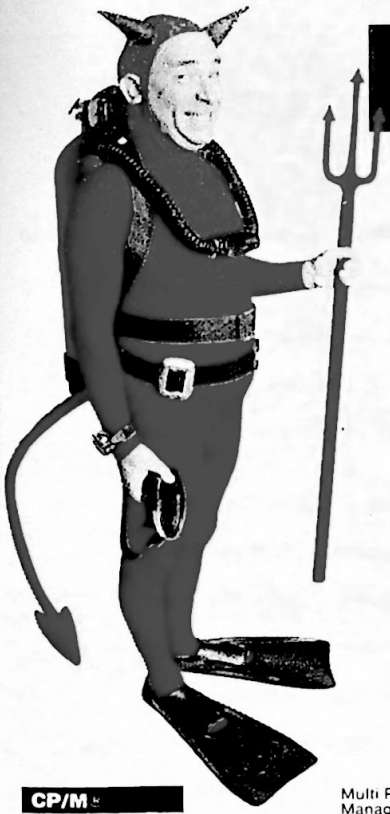

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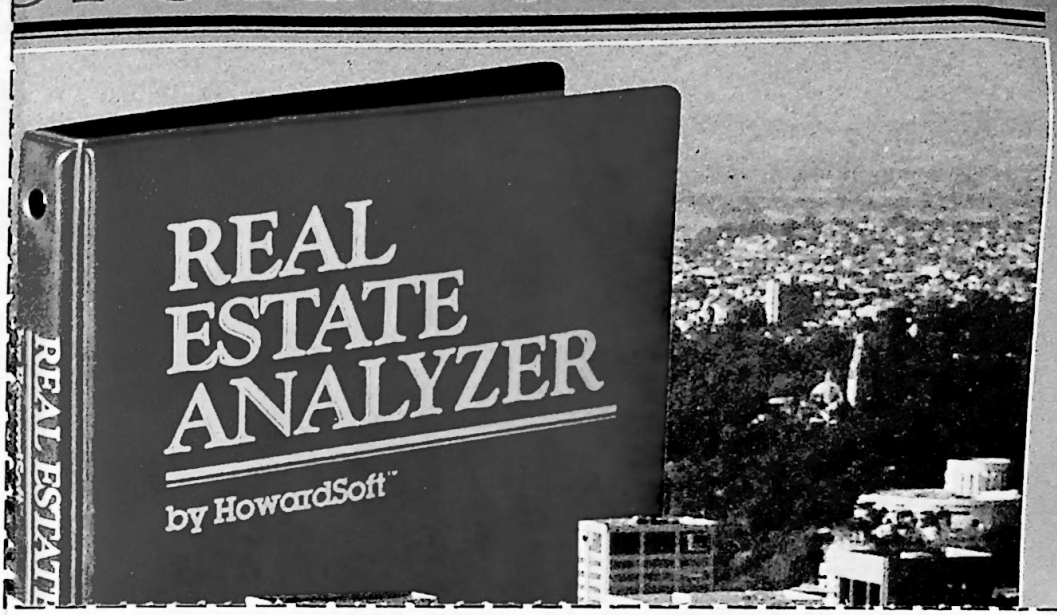

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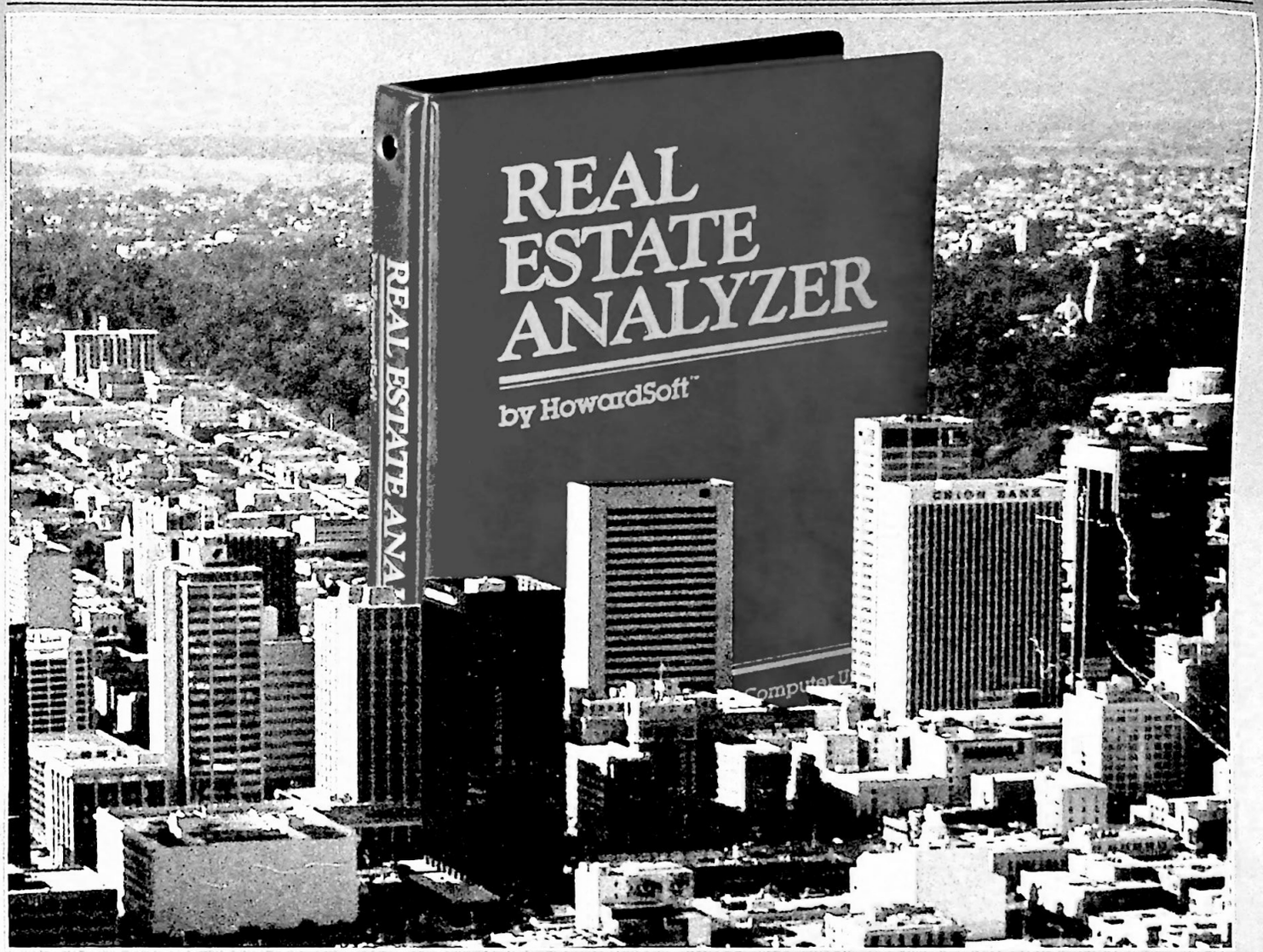

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